THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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(J. A. Berly's).

1914 EDITION

NOW READY.

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LONDON LABOUR DISPUTES.

DURING this week conflicting reports have appeared in the Press regarding the prospects for an early termination of the dispute in the London building trades. It is stated that the masters have taken steps in the direction of conciliation, and we believe that among the best of the workmen there is a growing recognition that they must be prepared to give a reasonable guarantee that they will not in future break agreements. The determination of the employers to have this matter definitely settled has been interpreted by the men as an act of war on the Trade Unions; but, at the time of writing, it is stated that representatives of the Unions have been invited to a conference. Apparently efforts have been made to arrive at some substitute which shall effectively take the place of the penalty clause that the men refuse to sign, but these have failed, and the conference now proposed will make another attempt. The employers' organisation was credited with taking steps to widen the area of the dispute, in the hope of more speedily ending it, but such measures, at least, stand deferred for the present. The Unions, with that same weakness for failing to keep their word which the masters want to remove for the future, are failing to comply with their resolutions to support each other, and the London District Committee has decided to expel from the Federation the Unions that have refused to comply with those resolutions by withdrawing their labour from firms presenting the obnoxious penalty document.

The dispute possesses electrical interest solely because the electrical workers, through their Union, are pledged to give their support. It has, of course, its larger bearing as a national industrial question, for in days when we seem, we hope temporarily, to have forgotten our proud boast that "an Englishman's word is his bond," all employers are asking that there shall be some greater certainty that understandings when signed shall be faithfully acted upon. The Unions as organisations are obviously at loggerheads between themselves, and if we do not seriously mistake, the members of the individual Unions are far from unanimous. It is easy for agitators to use strong language, and to persuade unthinking hearers, while together in the mass, that the day of the capitalist is past for ever, but the individual member of a union seldom seriously thinks when he is alone that that is the case. And hearing as one sometimes does of what goes on behind the scenes, it is plain that the bold policy advocated, and the bold front shown, by the "leader," have only been approved by a majority. We are merely giving away a secret divulged to us by a very talkative agitator when we say that we believe the recent fighting policy of the Electrical Trades Union was only carried by silencing some who were favourably disposed toward less militant measures. Indeed the Union's own organiser a few weeks ago denounced some present at the Memorial Hall meeting

because they would not consistently hang together. There is obviously an element in the Union that does not want "war." Further, we have before us a report of what is called a "straight talk to Sheffield electrical workers." The speaker was the general president of the Union, and he castigated his audience because they had not done their duty. "The arrears of contributions of the Sheffield district were a disgrace. Other branches were in arrears, but Sheffield was worse than the majority. In the event of a strike those in arrears would know where they were when they didn't get strike benefit." And this is the strong organisation whose spokesmen tickled the A.E.S.E. meeting with promises of the great financial resources that would be at their backs if they only agreed to act co-operatively at the given signal! We congratulate the A.E.S.E. upon its resolves to continue untramelled by unionist ties, and we wish it every success in its worthy efforts.

The London Electrical Masters' Association has issued a new schedule, which we reprint on a following page. It is willing to agree to certain increases in wages and alterations in conditions. It is anxious to raise the status and efficiency of the worker and the quality of the work done, and to that end it stipulates that before a man can be regarded as a fully-fledged wireman he must have qualified either by apprenticeship or by experience. Many points are covered in these rules, which we hope will receive fair and dispassionate consideration from all interested, but few of the rules are of such deep concern as that which preserves the right to the employer to employ either Union or non-union labour, and to the worker to work unhindered and unmolested if he elect to remain outside the Union.

The electrical workers have their own questions to settle, and while of course electrical contracting work must necessarily be somewhat hindered if building work is at a standstill, they will be acting in their own bread-and-butter interests if they adopt a conciliatory tone and do not place too much faith in the support that may be looked for from non-electrical unions. The E.T.U. will be well advised to sit down and consider the L.E.M.A. proposals seriously, and not to reject them as summarily as is said to be likely.

Lead.

The tangled skein in Mexico is the cause of the lead position being still unsettled, and it looks as if the threads were for the time being inextricably mixed up. But for the suspension of supplies from this country, there is little doubt that lead would have responded to the influences which have held sway with other metals, and that prices would have been now on a much lower basis than is actually the case to-day. There, however, seems to be not the least chance of better things in the near future as regards the supplies which are coming forward. A week or two ago it was reported that things were improving, especially in the northern parts of the country, and that some of the smelting plants there were getting back to work, including the Chihuahua smelter, but even if this were correct the situation in the southern districts is so much worse, that the general position cannot be said to have improved at all. At Torreon, for instance, there has been fierce fighting, and with the district in the hands of guerilla bands which have been terrorising the countryside, it is too much to hope for any resumption of normal industrial conditions yet awhile. Lead, indeed, depends upon the Mexican position as much now as it did a few months ago, and unless and until Mexico improves, it is hopeless to anticipate any material relaxation in prices. Supplies from the producing countries, apart from Mexico, are very limited, and show a singular lack of response to the high prices at which the metal stands. With the Far East taking lead more freely, as seems to be the case from the much larger sales made to Japan, China and India, so far this year by the Broken Hill Proprietary Co., the quantities available for Europe may be reduced further. There does not appear to be the least chance of lead coming in from the United States to meet the deficiencies of the position, for the restriction of supplies of raw material, which is a direct consequence of the Mexican trouble, affects the output of soft lead in the United States to a material extent. As regards the market position, this seems to be fully sound, and there is still a bear account to be covered, while the consuming trades are none too well supplied, and a regular hand-to-mouth business is being done by the rollers and electrical trades. The Continental position appears to be pretty fair, and really good in Russia, to which market large quantities of lead are to be sent as soon as navigation reopens. This will be early this year. Considerable buying for this market has been in progress for weeks past, and the demand has naturally rather slackened off of late, but a good deal of metal is booked for despatch soon. The demand is now a little less urgent than it has been, and any material slackening in this respect for early lead would no doubt result in a temporary easing in the position, but for all this there is no alteration for the worst to be anticipated at present.

Contracts in Norway.

The British Consul in Norway has recently collected particulars as to the extent of the participation of British firms in Norwegian Government and municipal contracts, particulars of which are forwarded by him, as they occur, to the Commercial Intelligence Branch of the Board of Trade for the information of British manufacturers and contractors. It appears that out of 30 contracts awarded by the State railways at Christiania (omitting coal contracts), only three were secured by British firms. The following particulars have been furnished by the authorities to explain why British firms do not achieve greater success. In 9 of the 27 cases in which contracts were not awarded to British firms, no British tenders were received at all; in 16 cases British tenders were received, but were too high compared with the tenders accepted; in the two remaining cases it is not certain if British goods were offered among the rejected tenders. Moreover, five of the unsuccessful British tenders would have been disqualified in any case, owing to want of care in complying with the stipulations.

The chief cause of want of British success would seem to be too high prices. It is true that Norwegian manufacturers enjoy a preference in Government contracts of some 10 to 15 per cent., but this does not appear to prevent a large proportion of the contracts being secured by the resident agents of foreign firms who compete with British firms under equal conditions. A well-known Norwegian business man confirms the impression that in many cases British offers for these contracts are too high, or allow for too wide a margin of profit, as compared with those of Continental firms, and that British firms are not careful to appoint local resident agents, who are necessary to tender for Government contracts on their own behalf. The Consul's informant suggested that these contracts are largely secured by the agents of firms who are already known to the authorities from former deliveries, or (if by new firms) by those who tender at low prices, resulting sometimes in loss, either owing to ignorance of local conditions, or in order to get an entry into the market, or who wish to dump superfluous stock at a sacrifice. Doubtless there are times when British firms are too much engaged on large orders to find it worth while to compete in the Norwegian market. Nevertheless, it is felt that British manufacturers do not take full advantage of the friendly feeling towards them which prevails in Norway. As one man put it: "We would prefer to do business with your country, if only your countrymen's prices were not so prohibitive" (*i.e.*, compared with Continental prices).

In the case of Government contracts, there would appear to be no official departmental list of contractors. All Government contracts above a certain value must, at least formally, be put up to public tender. It is thus usually of little or no use for British firms to ask for the names of the authorities to whom tenders should be sent or to be placed on the official list in the hope of being thereby invited to

tender when occasion arises. The better method is, while keeping in touch with the Commercial Intelligence Branch of the Board of Trade for news of contracts, to appoint local resident agents whose duty it is to look out for openings and communicate with the individual authority concerned in each instance. The Commercial Intelligence Branch of the Board of Trade is in possession of lists of agents who are members of the Christiania Agents' Association, divided up under practically all the chief branches of trade likely to occur in connection with Government contracts.

Electric Driving in the Mill.

Elsewhere in this issue we publish a short illustrated description of an electrically-driven textile plant which possesses features of considerable interest. In this case the mill had been in existence for a good many years, and there could be no doubt whatever that the friction load associated with the mechanical drive represented quite a considerable drain on the power plant at the mill, and that in this respect, at least, electrical transmission would prove a profitable substitute. Similar conditions exist in numerous mills at the present time, and it is generally agreed that, in these cases, electrification would be financially justified. But it is just on this question of carrying out the electrification that a difference of opinion is apt to arise, for while admittedly the conditions under which a machine, or group of machines, operates must exercise some influence on the driving arrangements, those conditions are interpreted so variously by engineers interested in this subject that we find advocates of schemes involving anything from one motor per mill to one motor per machine.

It is true that the electrical engineer rarely has a free hand in arranging a textile mill-drive, and that the installation of one motor, in place of an engine, to drive a mill, or a single motor to drive a weaving shed, for instance, is the utmost which considerations other than those of an engineering nature would permit of in some instances. At the best, however, such a scheme is usually but a half-hearted application of electric driving, as it obviously retains in great part the defects of the original mechanical transmission, including its friction load.

There is, in fact, little doubt that as between the extremists in individual and group driving, the former in any case risk far less in the matter of success than the latter.

In the particular mill referred to in our pages—a woollen mill which is somewhat exceptional in that every process of manufacturing involved in turning the raw material into the finished cloth is carried out in the one establishment—the question of individual or group driving naturally arose, and as a result of investigation of the conditions, the former system was adopted wherever possible and the latter where it was not easily avoidable. Among other things, it was found that on the average the machines were standing 40 per cent. and running 60 per cent. of the time, and this influenced the owners in favour of individual driving in order to get rid of the idle power load.

Although an increase in power costs should not weigh heavily in the scales as against increased production, an instance occurs to us of a Scottish group-driven jute mill using direct-current motors and purchased energy, where, owing to the cost of power, the question of reverting to steam driving was raised. Fortunately the owners were persuaded to experiment with a few looms individually-driven by three-phase motors, and in the end discarded their group drive in favour of individual driving for the weaving and preparation machinery, calenders, &c. The result was a saving of over 20 per cent. in power costs, using purchased three-phase current, and an admitted increase in production of 10 per cent.

Group driving has in the past been probably an unavoidable compromise, and we believe that in the future the conditions will be interpreted more and more to favour individual three-phase driving. Amongst many examples, we may mention one well-known Lancashire concern, which has, we understand, over a thousand motors in use, almost all for individual driving, the plant having been converted in sections as experience showed its success.

Of this we feel convinced—that the time has arrived for the whole position, particularly as regards methods adopted and results obtained, to be carefully reviewed in the light of the ample experience gained in this country and abroad.

A definite purpose is in view and indefinite methods should be avoided as far as possible. Not only the mill-owner, but also the manufacturer of electrical plant would benefit greatly if the textile applications of electricity were carried out on more definite and standardised lines.

Reactance.

The singular changes to which electrical practice is so remarkably subject are well exemplified in the paper read by Mr. Hollis before the Institution of Electrical Engineers, which we abstract elsewhere in this issue. As the author points out, it is not long since every effort was made by the designers of alternators to reduce the reactance of their armatures, in order to secure good regulation, and the specification of the Engineering Standards Committee contained a clause restricting the rise of pressure from full to no load under constant excitation. But the difficulties met with in the design of turbo-alternators, resulting in increased cost of manufacture without commensurate advantages, led designers to protest against the craze for excessively low inductance, and more recently the construction of machines with very large outputs, entailing disastrous consequences in the event of short circuit in or near the armature, has changed the situation, and now a reasonable amount of armature reactance is looked upon as not only harmless but desirable; moreover, it has become a common practice, especially in the United States, to add reactance external to the machine, to protect it and other apparatus against the effects of a short. The addition of reactance outside the machine has far less effect on the regulation than inside, because it does not increase the armature reaction also.

Very much the same applies to transformers, which to regulate well must have the minimum of internal reactance; in this case, however, the importance of good regulation is preponderant, and it is not usual to provide much internal reactance under ordinary circumstances, nor is it economical in first cost to do so.

Reactance is of the greatest value in the operation of rotary converters, enabling the D.C. pressure at the brushes to be automatically regulated according to the load; it is also most useful in connection with long-distance transmission lines abroad, greatly reducing the difficulty of maintaining constant pressure at the delivery end, in conjunction with synchronous motors or converters, which can be made to take a leading current. Again, where alternators of low reactance are to be run in parallel at widely separated points on a common network, interposing appreciable resistance between the generators themselves, or between the generators and synchronous motors, a certain amount of reactance is necessary to ensure satisfactory running in synchronism.

A point referred to by the author deserves special emphasis in the case of reactance used to limit the effects of short-circuits—namely, that while the average power developed by current and voltage 90° out of phase is zero, the instantaneous values of the power may reach enormous + and − values; and the mechanical stresses produced by wattless currents are just the same as those produced by watt currents, being independent of the voltage. While reactance in series with each generator limits the short-circuit current of that machine, it should be borne in mind that if several machines are running in parallel, enormous currents in the aggregate may be poured into a fault. For this reason there is much to be said in favour of reactances inserted between successive sections of the bus-bars, which are more efficient in localising the effects of a fault.

Mr. Hollis sketches out an ingenious idea of loading transmission lines somewhat after the manner of telephone cables, and providing sources of leading currents to enable the system to be made self-regulating and self-protecting; we doubt whether it would be found feasible in practice, but the idea should not be lost sight of—we never know what may become standard practice 10 years ahead. There is no doubt that reactances, acting as buffers, may be used to increase very greatly the reliability of supply, and the subject deserves more attention than it has hitherto received this country.

ELECTRICAL WAGES IN THE LONDON DISTRICT.

We print below the new working rules for the London district that have been approved and published by the London Electrical Masters' Association (secretary, Mr. L. G. Tate, 20, Bucklersbury, London, E.C.). We give them in extenso for the information of those who desire to make a comparison with the old rules of the Electrical Contractors' Association and those proposed by the Electrical Trades Union, concerning which Mr. R. W. Weekes wrote in our issue of February 6th, page 212. Mr. W. R. Rawlings is chairman, and Mr. H. J. Cash, deputy chairman, of the Masters' Association, and the following constitute the committee :—

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Area.—The area under which these rules shall apply is to be taken as within a radius of 12 miles from Charing Cross.

Scope of Rules.—These rules are not intended to apply to work on the undertaker's side of a supply authority's terminals, or to employés who may be engaged for full time in a factory on manufacturing work.

Rules.

1. *General.*—No exception shall be taken to the employment or non-employment of any workman in the electrical trade on the ground that he is or is not a member of any organised Trade Society, neither shall any exception be taken to the employment of a workman in any other trade on the ground that he is or is not a member of a Trade Society.

2. *Working Hours.*—The recognised working hours shall not exceed 53 per week.

3. *Night Shift.*—Workmen engaged on a "night shift" shall be paid 1d. per hour in addition to the ordinary rate of wages, provided that workmen on a night gang shall not have been employed during the preceding day. The hours worked without overtime rates not to exceed 10 per day of 24 hours. Double time to be paid for all time worked between Saturday midnight and Sunday midnight.

4. *Overtime.*—Overtime to commence after a day's work of 10 consecutive hours (meal times excepted), and to be paid at the following rates :—Up to 8 p.m., time and a quarter ; from 8 p.m. to 10 p.m., time and a half ; from 10 p.m. to starting next day, double time. Saturdays—from 1 p.m. to 4 p.m., time and a half ; after 4 p.m., double time. Christmas day and Sundays, double time. Each day to stand by itself. If the work continues after 1 a.m., and there is no ordinary means of conveyance home available, workmen shall be paid at overtime rates up to 6 o'clock next morning, unless some means of conveyance to their homes is provided by the employer.

5. *Wages.*—The following are the recognised rates of wages, and shall be observed as such :—

Wiremen, on and after the first pay day in April, 1914, 10d. ; on and after July, 1914, 10½d.

Pipe Fitter only, on and after the first pay day in April, 1914, 9d. No pipe fitter shall be engaged on wiring. Should wiremen be employed on pipe-fitting, their rates should be maintained as wiremen.

Improvers.—After having been indentured or engaged for three years, to be paid at not less than the following rates :—Up to the end of the fourth year, 4d. per hour ; fifth year, 5d. per hour ; sixth year, 6d. per hour ; seventh year, 7d. per hour. Apprentices subject to agreement with employer.

At least half the hands engaged on the actual erection of electric wires, tubes, casings, or fittings shall be wiremen or pipe fitters, or in receipt of equal rates of pay.

6. *Notice of Determining an Engagement.*—One hour's notice on either side.

7. *Payment of Wages.*—Wages shall be paid on the job, but if otherwise arranged, travelling time and expenses shall be allowed to get to the pay-table.

8. *Travelling Expenses.*—Workmen who are sent from the shop to a job to any point more than two miles from the shop within the London district, shall be allowed workmen's fares daily, but no travelling time, from the shop to the job, but this rule shall not apply to men taken on at the job.

9. *Country Expenses.*—Where men are sent outside the area covered by these rules, they shall be paid at the rate of 1s. 6d. per night, but when away for less than seven days at the rate of 2s. per night, together with fares out at the commencement of the job, and home on completion. Travelling time at ordinary rates. Such men to have the option, where circumstances permit, of working two hours per day extra without overtime at ordinary rates.

10. *Wireman.*—A fully-qualified wireman must be over 21 years of age, and have served an apprenticeship or have been engaged in the trade for a period of not less than seven years.

11. *Improvers or Assistant Wiremen.*—Shall either have been indentured for a term of not less than three years, or have been continuously engaged by a responsible firm or firms for a similar period in learning the trade of wireman, but have not the qualifications mentioned in the definition of a wireman.

12. *Apprentices.*—All apprentices shall be properly indentured for a term of not less than three years.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

A Motor Problem.

I should be glad if any of your readers could assist me in the following problem that I have recently had before me. It is desired to use a motor to drive a machine in which the power required is not directly proportional to the speed ; for example :—10 H.P. at 325 R.P.M., and 15 H.P. at 400 R.P.M. Of course, the usual method would be to have a motor to develop 15 H.P. at 325 R.P.M., and increase the speed by shunt regulation. Is it possible to have a motor to develop 10 H.P. at 325 R.P.M., and by shunt regulation only to increase to 400 R.P.M., thereby increasing the load of the motor to 15 H.P. ?

Perplexed.

The Cable Telegraph Service.

A paragraph recently appeared in a G.P.O. Journal with regard to the grant of substantial increases of salary by cable companies to their employés. While this may be true of the Eastern and Associated Companies, it is absurd to flaunt the idea that all cable companies are imbued with the same spirit of generosity.

At the present time, when a great deal of dissatisfaction has manifested itself in the ranks of the British postal service, chiefly due to the increased cost of living, it may be of some consolation to those interested to know that, considering all things, those in the telegraph branch of the G.P.O. are in a far more enviable position than their colleagues in the cable service. It has been frequently pointed out by those competent to speak, and equally acquainted with the inner workings of both services, that there is a very wide distinction between the Post Office telegraphs and submarine cable work, the latter being a much higher branch of telegraphy. The strenuous and exacting work required by competitive cable companies to-day is too well known in telegraph circles, and for this reason the Post Office operator cannot be induced voluntarily to resign his position in the Government service for an appointment in the cable service, at an apparently increased wage, as was formerly the case. This being so, the conclusion is that the conditions of service in the Post Office have improved of late years, whilst those of the sister service have remained stationary.

The demand for skilled operators by cable companies far exceeds the supply, consequently the shortage is made up of "Stewmers" and undesirables of the telegraph world. This introduction of the undesirable element has been the cause of lost prestige in the eyes of the public both at home and abroad, to the social detriment of the better class.

Wage-cutting is no doubt mainly responsible for this state of affairs, and only those employed in the cable service can fully realise the limitations of the pay and promotion offered.

Again, the cable operator has no association or union to which he can look for assistance in promoting his cause ; he has to be content with the remuneration and treatment meted out by the company, and whatever grievances he may have must be kept to himself for fear of dismissal from the service as an agitator.

Many of our most important cable stations are located in desolate and isolated parts of the coast, miles from a railway, and as compensation to the "exile" a small allowance is given as an inducement. It is just by this

small amount that the pay of the cable operator exceeds that of his Post Office *confrère*.

It seems almost incredible to most people that such an important profession, with members scattered in every part of the world, who hold the business and commerce of great nations in their hands, should be unrepresented, and yet have remained pacified so long. It is only such generosity and forethought as is shown by the Eastern Telegraph Co. to its employés that helps to make the cable service what it originally was, and what it should continue to be. If other companies could be induced to follow the example of extending the same generosity to their staffs, continued loyalty would be assured, and the rank and file would be raised to the standard they attained in former years.

The writer of the above-mentioned paragraph would do well to banish from his mind the idea that cable companies are benevolent institutions any more than the British postal service, and from personal experience I do not hesitate to say that the British postal service of to-day is far preferable in every way to the cable service.

C. O.

Motors for Gassy Mines.

What is the latest practice with regard to the design of A.C. and D.C. motors to comply with the Home Office rules for use in gassy mines?

H. H.

Professional Etiquette.

Referring to the leader in your issue of the 27th ult., on "Professional Etiquette," I see serious objections to the publication of a visiting card in a technical paper by a professional man, if it involves any payment to the paper.

Further, if you refer to American publications, you will find that the advertisement does not stop at the name and address, but often states the qualifications and the specialities of the gentleman.

Humphrey M. Morgans.

London, E.C., *March 6th*, 1914.

Corrosion of Battery Plates.

Could any of your readers kindly explain the following curious defect shown in a storage battery of 54 11-plate cells, erected in, and hung on the sides of, glass boxes?

After being in use for nine months, all the positive lugs at the free ends of the plates developed what looked like a growth, and when this was cleaned off to prevent it falling into the glass box, holes of various sizes were visible on the lugs.

Accumulator.

"Charge" or "Shift" Engineer?

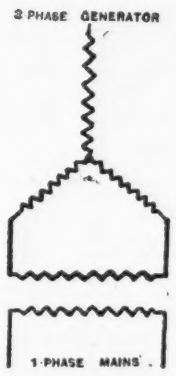
I should be glad to know the qualifications which constitute a "shift engineer," and a "charge engineer"; my reason for asking is that latterly I have been in the running for several appointments going for "engineers-in-charge," and have found that, where reference was made to my present position, I have been styled as "shift engineer." This may or may not be the stumbling block to my success, but it would be interesting to know the opinion of other readers as to whether this title is detrimental to my advancement. I may state that at the present time I am responsible for the operation and maintenance of steam and electrical plant of about 5,000 KW. capacity, all testing and repairs to such being carried out under my personal supervision during the week-ends (shifts being 12 hours day and night), which I take alternately with my colleague. Should you think this letter of sufficient interest to publish I should be greatly obliged.

An Old Reader.

[The question is very timely; the distinction between the two designations undoubtedly is somewhat indefinite. We should regard "charge engineer" as connoting the possession of capacity and fitness for responsibility superior to the attainments of a "shift engineer."—Eds. Elec. Rev.]

A Query.

I am interested in the question raised by "Ignoramus," but why does he specify that the load on the three-phase should be balanced, for the simplest, cheapest and most efficient way is to take a single-phase supply from two windings of the three-phase plant, as shown in the diagram. This is quite practicable if the single-phase load is small, as is usually the case, compared with the capacity of the three-phase supply. (I have heard that the single-phase



railway in London is supplied from two windings of a three-phase generator, and I shall be glad if you can confirm this rumour.)

I shall be glad if Mr. Raynor will state if the arrangement described by him is in use to any extent and its efficiency.

Mr. Johnstone's reply is not a very satisfactory answer to the question. His first diagram is not practicable, for the result would be similar to that obtained on a three-wire system without balancers (unless a connection were made between the star points of generator and transformer.) Transformers connected as shown in his second diagram will carry a considerable out-of-balance current.

B.

Reversing an Interpole Motor.

Would you please inform me, through your paper, the best way to quickly reverse the direction of rotation of an interpole shunt motor? Is it correct to reverse the brush leads, only leaving the fields, shunt and interpole coils alone? Some books say reverse armature current and interpoles, leaving shunt coils alone. What I want to know is if I reverse the brush leads, whether shunt or compound-wound interpole motor, will the machine be right, provided it was running correctly under load in the opposite direction before? I have asked several electrical engineers, and had very contradictory instructions.

Puzzled Winder.

Protection or Tyranny?

My attention has been drawn by the letters which have recently appeared under the above heading to another aspect of the rules of that somewhat ungrammatically titled body, the "British Electrical and Allied Manufacturers' Association," which is certainly more deserving of the heading than the one which has so far been dealt with, for purchasers, whether individuals or corporate bodies, can always protect themselves by methods quite unavailable to the worker.

The particular rule of the B.E.A.M.A. to which I wish to draw attention is one to which, if true, it were no misuse of words to apply the epithet "scandalous."

I understand that the gist of the rule is that should any employé of one member (A) of the B.E.A.M.A. apply, through advertisement or otherwise, to another member (B) for employment, then (B) shall immediately inform (A), and before taking the applicant into his employ, shall obtain the permission of (A).

I have no doubt but that the most philanthropic considerations contributed to the framing of this rule, but it requires very little thought to understand how impossible it

D

is for a worker to improve his position under such circumstances, for the good worker is kept where he is, whilst the less efficient worker is not wanted by other employers, and is probably not retained by his present one.

Further, I would point out that almost all the principal manufacturers in all branches of the electrical industries are members of the B.E.A.M.A., and that the rule applies to all grades of workers, from the office boy or the greaser to the general manager—many thousands in all, most of whom are entirely ignorant of the fact that they are living under such tyranny—a tyranny which cynically and shamelessly violates the most fundamental of those laws which concern the liberty of the subject.

I do not desire for one moment to divert attention from the important aspect of the case at present under discussion—in fact, I join with Mr. Purse against the B.E.A.M.A., and think, with "Pollux," that the best way of dealing with the B.E.A.M.A.'s conditions is to submit them to the judgment of the public interested in the electrical trades.

It is for this reason that I venture to claim the hospitality of your columns.

Junius.

[We have no knowledge of the existence of the rule mentioned by our correspondent. Perhaps the Association may have something to say on the matter.—Eds. E.R.]

BUSINESS NOTES.

Electric-Light Switching Competition.—We are informed that there are nearly 200 entries in the competition conducted by our contemporary *Electricity*. Candidates had to send in answers to one of three sets of examination questions on the principles and practice of controlling lights by means of modern tumbler switches. These questions showed that there is very much more in the subject than many people suspect. The detailed results of the competition, with the names of prize and certificate winners, will be published in the April 24th issue of *Electricity*. The examiner is Mr. W. Perren Maycock, M.I.E.E.

Lantern Slides.—Messrs. Berry Skinner & Co. have prepared a series of lantern slides of their foolproof fuse-switchgear and "Ironsafe" switchboards. They will be pleased to lend these slides to engineers or lecturers at engineering societies who may be interested in this particular subject. Application should be made to the firm's head office at 78, Upper Thames Street, London, E.C.

Cinematograph Apparatus.—With reference to the new Westinghouse list of cinematograph supplies mentioned in these columns last week, we are asked to state that the British Westinghouse Electric and Manufacturing Co., Ltd., propose holding an exhibition of cinematograph and theatrical supplies and apparatus at 179, Wardour Street, London, W., from March 16th to 23rd, inclusive.

Trade Announcements.—With reference to our last week's notice of dissolution of partnership of W. F. Dennis & Co., we are asked to state that the retirement of Mr. F. W. Dennis will in no way affect the conduct of the business, which will be carried on, as heretofore, by Mr. F. A. B. Lord and Mr. J. E. Hood, who has now been admitted a partner. Mr. L. H. Hurburgh, who has been in the firm's employ for many years, will also assist in the management.

Mr. James Douglas announces that, having purchased the goodwill, patents, patterns, tools, &c., from the liquidator of the Accessories Manufacturing Co., Ltd., the business will in future be carried on under the name and style of the "Accessories Manufacturing Co.," at 11, Dean Street, Soho, London, W.

Messrs. H. R. Witting & Partners (now changed from H. R. Witting), removed on March 6th from Berners Street, W., to 125, High Holborn, W.C.

Messrs. Arthur Jones & Co. have commenced business as electrical factors at 15, Dock Street, Middlesbrough. Mr. Jones was sales manager for some years with the late firm of Warren, Beattie & Co., Ltd. The firm invite manufacturers and large wholesale suppliers to send catalogues, &c.

In future, all communications for the Benjamin Electric, Ltd., should be sent to 1A, Rosebery Avenue, E.C., where their sales office will be established; telephone number, "Holborn 1830." During the last two years the company have very considerably increased their manufacturing facilities at Rosebery Avenue.

J. & G. Odhams, ironmongers and manufacturing electricians, 206 and 207, Upper Thames Street, E.C.—Mrs. Rose Elizabeth Odhams, administratrix of the estate of the late M. G. Odhams, has transferred his and her interest in the goodwill, stock-in-trade, &c., in the business to Mr. G. P. Odhams, who will attend to debts and carry on the business, under the same style, at the same address.

Mr. R. Barron, who is in business as an electrical engineer at Fleetwood, has recently had his premises extended, and has made provision for a large showroom.

Catalogues and Lists.—Messrs. Morris & Lister (London), Ltd., Palace Chambers, Westminster, S.W.—Sixteen-page list (No. 342), giving illustrated particulars and prices of "Bacho" electric drilling and grinding machines.

Messrs. Neville's (Liverpool), Ltd., 7-9, James Street, Liverpool.—Eight-page list describing and fully illustrating Universal angle-bending machines, and showing their application in dealing with all sections of bars, tubes, &c.

Messrs. Falk, Stadelmann & Co., Ltd., 83-87, Farringdon Road, London, E.C.—New catalogue (No. 377 February) of electric bell and telephone manufactures. It is of the firm's uniform size of page, and consists of 100 pages. A very complete range of electric bells is included, also the "Farringdon" bell, which is a speciality of the firm, and the "Atlas" secure locking indicator, which has a movement that the firm claims cannot possibly shake down, and can only be actuated by electrical action. This is one of a range of indicators of various types. Wood, china, brass pushes, and the usual complements to an electric bell catalogue, such as batteries, bell wires, flex, are exhaustively dealt with. The firm specialises in portable flash lamps of which a range is shown. The catalogue having been thoroughly revised, brought up to date, and all prices carefully calculated on current costs, the advances which have heretofore had to be charged are now entirely eliminated.

Messrs. Siemens Bros. & Co., Ltd., Woolwich.—Supplement 2 to Catalogue 532 contains illustrations and prices of high and low-tension motor-car leads.

Messrs. Adam, Rouilly & Co., 18, Fitzroy Street, London, W.—8-page illustrated and priced pamphlet, containing particulars of their "Rational" light reflector and bowl fittings.

Messrs. Krupka & Jacoby, Ltd., Chapter Street, Westminster, S.W.—Two leaflets, giving prices, &c., of flexible wires, bell wires and 600-megohm grade cable.

The Westinghouse Brake Co., Ltd., 82, York Road, King's Cross, London, N.—40-page illustrated catalogue (fifth edition) of their oil engines (Cross patents). Very fully illustrated details of the engines and parts of same are given, and small self-contained electric power and lighting sets and portable power plants are included.

Messrs. W. F. Dennis & Co., 49, Queen Victoria Street, London, E.C.—24-page catalogue, containing a full and illustrated account of the "Steidle" semi-automatic telephone system, its purposes, parts, application and operation. The main idea of the system is economically to link up outlying districts with an existing central exchange. It is the work of the South German Telephone Apparatus, Cable and Wire Works A.G., of Nuremberg, for whom Messrs. Dennis are sole agents here.

The Century Electric Co., St. Louis, U.S.A.—Two illustrated catalogues dealing respectively with single-phase self-starting motors of the repulsion-induction type, and alternating-current fans.

Messrs. J. W. Brooke & Co., Ltd., Adrian Works, Lowestoft.—Forty-eight page illustrated catalogue of marine motors and motor-boats.

Paracit G.m.b.H., Frankfurt-am-Main.—Brochure describing "Paracit," a new artificial insulating material mainly composed of cotton, and used either in the solid or dissolved form in the manufacture of electrical apparatus.

Messrs. Lester B. Betts & Co., 9, London Street, London, E.C.—The first number of *Betts's Bulletin*, a monthly publication of 16 pages containing prices and illustrated particulars of portable electric drills, electric fans and lighting fittings, and tabulated prices of many accessories.

Messrs. Willans & Robinson, Ltd., Rugby.—Forty-page illustrated brochure very fully describing their disk and drum steam turbines, with numerous half-tone illustrations of complete plants, also drawings and pictures of parts of machines. Seven pages at the end are occupied with tabular lists of public and other purchasers of their turbines, and particulars of the machines supplied.

The Electrical Supplies Co., 41, Cheapside, London, E.C.—Illustrated descriptive price list of paraffin-electric sets for picture palaces, yachts, portable service, country house lighting, &c.

Electrical Apparatus Co., Ltd., Vauxhall Works, South Lambeth Road, London.—Leaflet (H 19 P) contains description and prices of direct-current steel-clad motor-control pillars.

Dissolutions and Liquidations.—The Harrington Electric Light Co., Ltd.—A meeting will be held at the offices, Leopold Street, Long Eaton, on April 7th, to hear an account of the winding-up from the liquidator, Mr. W. Bladon Smith.

E. & V. Page & Co., electric suppliers, agents and merchants, 1, Dyer's Buildings, Holborn, E.C.—Messrs. Edward Percy Page and Victor Arthur Page have dissolved partnership. Mr. E. P. Page will attend to debts and carry on the business under the style of Edward Page & Co., at 28, Ely Place, Holborn, E.C.

New Superheater Co., Ltd.—A meeting of creditors will be held at 155, Salisbury House, London Wall, E.C., on April 14th, to hear an account of the winding-up from the liquidator, Mr. S. G. Bruff.

Bankruptcy Proceedings.—Clifton Robinson, London.—The Bankruptcy Court on Tuesday approved a composition of 10s. in the £, and discharged the order. Extravagance was the cause of failure.

Sequestration notice has been published in the *Edinburgh Gazette* respecting James Haig Willey, electrician, 20, Blackhall Street, Paisley.

A Calcutta Exhibition.—A financial daily states that preliminary arrangements for an International Exhibition to be held in Calcutta have been proceeding for some time.

Book Notices.—The March issue of "Concrete and Constructional Engineering" contains the first of two illustrated articles on "Concrete Masonry in the Panama Canal," by Mr. J. G. Leigh, and a description, with illustrations, of the Central Arno hydro-electric station near Milan, which has some unusual constructional features.

"Photo-Electricity." By A. L. Hughes. London: Cambridge University Press. Price 6s. net.

"Engineering Index Annual for 1913." New York: Engineering Magazine Co.

"Science Abstracts." Sections A and B, Vol. XVII, Part 2, February 25th. London: E. & F. N. Spon, Ltd. Price 1s. 6d. net each.

"*Proceedings* of the American Society of Civil Engineers." Vol. XL, No. 2. February. New York: The Society.

"The Physical Review." Vol. III, No. 2. February. Lancaster, Pa.: The American Physical Society.

"*Bulletin* Scientifique de l'Association des Elèves des Ecoles Spéciales." Vol. XVI, No. 3. January. Liége: Lahaye & Co. Price 1 fr.

"*Bulletin* Mensuel de la Société Belge d'Electriciens." Vol. XXXI. February. Brussels: E. Bruylant. Price 1 fr. 75c.

"Giornale ed Atti della Associazione Elettrotecnica Italiana." March 5th. Milan: The Association. Price L1.

Denmark.—The Danish Customs authorities have recently given a decision to the effect that "electric heating stoves" are to be classified under No. 301 of the tariff, the duty being 7½ per cent. *ad val.*

Patent Application.—The Worthington Pump Co., Ltd., have applied for restoration of Patent No. 18,866 of 1910, for "Hydraulic air compressor or pump," granted to O. H. Mueller.

LIGHTING and POWER NOTES.

Alaska.—The Bishop of Alaska has authorised the head of the electrical engineering department of the University of Pennsylvania to design an electric lighting plant, operated by a windmill, for the use of the Episcopal Mission at Point Hope, Alaska, which is more than 100 miles north of the Arctic Circle.

Altrincham.—Street Lighting.—The Council has decided to seek permission to borrow £750 for lighting the main streets by electricity.

Argentina.—The Buenos Ayres municipality has approved the plans presented by the Compania Italo-Argentina de Electricidad relating to its installations for the supply of electricity. The company is required to install a minimum of 15,000 kw. during the eight months following the approval of the plans.—*Review of the River Plate.*

Blackrock.—E.L. Scheme.—The U.D.C. has appointed Mr. J. P. Tierney, electrical engineer, to advise on the proposed E.L. schemes.

Bradford.—Hospital Lighting, &c.—The Health Committee has decided to recommend the City Council to install electric lighting at Leeds Road Hospital, in lieu of gas, at an estimated cost of £366.

The Sites and Works Sub-committee of the Education Committee has resolved that, owing to the unsatisfactory condition of the gas mains at Odsal House, arrangements be made for the building to be lighted by electricity.

Braunton.—E.L. Scheme.—The P.C. has accepted the offer of Mr. J. Dennis to supply E.L. in the hamlet of Knowle at £1 per lamp per annum, and the payment of £15 towards the capital outlay for seven years. Overhead wires will be used.

Bristol.—Street Lighting.—In connection with the offer of the Electricity Committee to supply free electricity to over 1,100 street lamps at present lighted by gas, the estimated saving being £1,000 per annum when the cost of changing over has been met, a Councillor intimately connected with the Ratepayers' Association has objected to the inclusion in next year's estimates of £390 expenditure on altering gas lamps for the electric lighting.

Bury.—Workhouse Lighting.—The Electricity Committee is negotiating with the B. of G. for the supply of electricity to the workhouse at Jericho, at an estimated cost of £3,200.

Carlisle.—L.G.B. Inquiry.—An inquiry was held on March 4th by Mr. W. N. Cross into the application of the Corporation for sanction to borrow about £30,000 for extensions to the electricity works plant and mains.

Clacton-on-Sea.—Street Lighting.—The U.D.C. has appointed a committee to consider the lighting of the principal thoroughfares with electric arc lamps.

Clutton (Somerset).—The B. of G. has decided upon an E.L. installation, at an estimated cost of £835.

Connah's Quay.—Proposed E.L. Scheme.—The U.D.C. has applied to the L.G.B. for a loan of £4,600 for carrying out an E.L. scheme. Plans are to be prepared by Mr. A. J. Leigh, of Northwich.

Continental Notes.—Austria.—A plan for providing Vienna with electricity on a large scale was recently outlined by the Austrian Government's consulting engineer, Karl Deinlein. He proposes to utilise the rainfall on the northern slopes of the Niederen Tauern mountains, in two power stations in the valley. Calculations show that 570,000 h.p. will be available, which far exceeds the capital's present wants, and can be supplied at so low a price as to ensure the success of the venture.

Baden.—Supply Statistics.—An official report has just been presented to the Upper House of the Grand Duchy of Baden in regard to the position of electricity supply in the Duchy at the end of 1913. It is shown that out of the 1,557 towns or communes, 521, or 33·5 per cent., are provided with a supply, and the population of the districts served amounts to 64·5 per cent. of the total population. The report submits that it is now the duty of the Government to intervene with a view to controlling the development of the supply. Agreement as to future extension of the supply has already been effected with a number of communal undertakings, and further negotiations are in progress. In addition to the expansion of the system, the report refers to the movement proceeding in the direction of the unification and combination of the supply in larger undertakings connected together. The overland central stations are endeavouring to join with the small local works, both technically and economically, and large communal works and private works are also combining. It is not disputed that if the whole of the production and distribution were concentrated in private hands the danger of a monopoly would arise. But so long as the rights and obligations of the large overland stations are controlled by the State, as is the case in Baden, no apprehensions are entertained that the interests of the public are likely to be prejudiced. Apart from this, the establishment of a monopoly will be checked by the Government Murg electricity works, now in process of construction.

Germany.—The Municipality of Heiligenstadt proposes to convert its power station into the centre of an extensive overland supply system, and is considering whether this shall work in conjunction or in competition with a scheme projected by the A.E.G. In the former case the town will have to raise £50,000 of the capital. Parts of the remoter rural districts are to be supplied from either the Sudhärzer Kraftwerke or the water power station at the Erdtalsperre.

Crewe.—The Electric Lighting Committee has received an application for the lighting of Spring Gardens.

Croydon.—Plant Extensions.—The B.C. has sanctioned works at a cost of £3,154, to supplement the existing H.T. system.

Darlington.—Loan Sanction.—The T.C. has received the sanction of the L.G.B. to a loan of £6,500 for new pumping and generating plant in connection with the water undertaking.

The electrical engineer has reported to the Council that he has been requested to tender for a large supply of electricity to the N.E. Railway Co. for power purposes.

Dover.—Proposed Loan.—The T.C. has applied to the L.G.B. for a loan of £500 for electricity purposes, including house services, the extension of mains to the River portion of the borough, and the installation of E.L. in cottages at the Pier.

Dublin.—Proposed Loan.—The Corporation has decided to apply to the L.G.B. for a loan of £77,000 for the extension of the electricity undertaking.

The promoters of the Alliance and Dublin Consumers' Gas (Electric Supply) Bill have given notice that they will object to the *locus standi* of the Dublin Corporation to be heard against this measure.

Edinburgh.—Fuel Economy.—As a result of the test of an Underfeed stoker at the Dewar Place electricity works, it has been found that coal at 4s. per ton can be used, as against fuel costing 8s. to 10s. per ton at present. The E.L. Committee has therefore recommended that seven additional stokers of the same pattern be installed, at an estimated cost of £1,890.

Exeter.—New Plant.—The E.L. Committee has decided to install a 1,000-kw. B.T.H. high-pressure steam turbo-alternator at the electricity works, at a cost of £4,211. The total cost of the work is estimated by the electrical engineer at £6,200, and the annual saving at £440 per annum. At a joint conference of the E.L. and Tramways Committees last week the town clerk stated that of £43,024 expended upon plant at the electricity station only £5,638 had been apportioned to the tramway undertaking, which would be entitled to borrow £11,541, after paying £3,000 for the additional cars to be purchased. As the tramways utilised about a third of the current generated, the E.L. Committee considered that the apportionment of capital between the two undertakings should be reviewed. It was resolved to borrow £6,200 for the turbo-alternator.

Glasgow.—Street Lighting.—A big scheme for improving the lighting of the streets is under consideration.

Hazel Grove.—A further canvass of residents is to be taken to ascertain the demand for electricity in the area, and the Electricity Sub-Committee of the Council has been authorised to engage the services of an electrical engineer or other suitable person.

Holywell.—Infirmary Lighting.—The B. of G. has decided that for the present the E.L. shall be installed in the new infirmary only; the lighting of the workhouse is to be deferred until a new classification is completed. Tenders for accumulators capable of lighting the whole institution are to be invited, and the specifications are to be prepared by Mr. A. J. Leigh, of Northwich.

Ilkley.—E.L. Scheme.—The Electricity Committee has adopted the amended plans of the electrical engineer for the erection of an electricity generating station, and the L.G.B. has consented to the work of cable laying being proceeded with at once. The L.G.B. inquiry into the scheme will probably take place next month. The Committee has decided that the cable laying be proceeded with immediately in accordance with the terms arranged with the Western Electric Co.

Keighley.—Proposed Loan.—The T.C. is applying to the L.G.B. for sanction to borrow £600 for electric motors to be let out on hire.

Kingstown (Co. Dublin).—E.L. Bill.—Mr. John Muldoon, M.P., has given notice of motion that it be an instruction to the Committee on the Kingstown Lighting Bill to insert a clause providing for the transfer of the undertaking to the Kingstown U.D.C. as might be approved of by the B. of T.

Knaresborough.—E.L. Scheme.—The U.D.C. has decided to apply for a prov. order to carry out the proposed E.L. scheme. Current is to be generated from the River Nidd, and the cost of the installation, &c., is estimated at £3,180. On a scale of 5d. per unit the estimated yearly revenue is £833, and the profit £312.

London.—Islington.—The B. of G. has received a letter from the L.G.B. stating that it is not satisfied with the proposal to install E.L. at the Board's institutions without further information, and, in view of an offer made by the Gas Light and Coke Co., the B. of G. has decided to hold an inquiry into the matter.

Woolwich.—Proposed Loan.—Application is to be made to the L.C.C. for a loan of £18,500 in connection with the electricity undertaking.

The L.C.C. Finance Committee has recommended the Council to sanction the borrowing of £500 for electricity meters by the Bermondsey B.C.; and £5,328, as to £2,142 for mains, £1,916 for services, and £1,270 for meters, by the Shoreditch B.C.

Malvern.—Proposed Bulk Supply.—At a meeting of the U.D.C. last week, a recommendation of the Electricity Committee to add a 150-kw. plant to the electricity works at an estimated cost, including extension of building, of £1,500, was discussed. It was stated that the Worcester Corporation had offered to supply Malvern with electricity in bulk, but the Committee felt that the offer did not warrant it scrapping its electricity works, which would have to be done if the offer was accepted. The discussion was eventually deferred for a month.

Merthyr Tydfil.—Bulk Supply Inaugurated.—The formal switching on of the bulk supply to the Merthyr Electric Traction and Lighting Co. took place last Saturday, at the Treforest power station of the South Wales Electrical Power Distribution Co. The visitors subsequently inspected the overhead transmission to Merthyr, and the 11,000/500-volt rotary converter plant installed there. The operations of the power company have extended greatly in recent times; included in its plant are two 6,000-h.p. turbine sets, while another of 10,000 h.p. is being erected at the present time.

Newport (Mon.).—Proposed Refuse Destructor.—A L.G.B. inquiry was held on March 5th into the application of the T.C. for a loan of £11,697 for a refuse destructor, proposed to be erected by Messrs. Heenan & Froude, Ltd. There was no opposition.

Oldham.—Referring to an increase in the coal consumption at the electricity works, the chairman of the Electricity Committee said he was informed that the increase was due to the turbine having broken down, and he strongly urged the Committee to spend £30,000 if need be on new machinery, so as to bring the figure down to 3 lb. of coal per unit.

Penmaenmawr.—E.L. Scheme.—A special meeting of the U.D.C. is to be held to consider the report of the consulting engineer with reference to the supply of electricity.

Peterhead.—Saving the Gasworks.—The local T.C. has been considering a scheme for supplying electricity in the burgh, but probably nothing will come of it, as the local Gas Committee has the matter in hand, and has taken the precaution to circularise the gas consumers to find out whether they will be "agreeable" to adopting electricity. With a view to assisting them in coming to a decision, the Committee informs them that electricity could be supplied at from 3d. to 4d. per unit for lighting, "which would mean that . . . . . the charge would be approximately 7s. 6d. to 10s. to be equivalent to 1,000 cb. ft. of gas at the present cost of 3s. 8d. per 1,000 cb. ft." And this with the metal-filament lamp! The circular is signed by the gas manager.

Radcliff.—Proposed Loan.—The U.D.C. has asked the L.G.B. to sanction the borrowing of £3,948 for the electricity undertaking, principally for new mains.

Rochdale.—Mill Driving.—The Corporation has arranged to supply 1,800 h.p. for electrically driving two new mills which are being erected between Sudden and Castleton. Half the supply is required by January 1st next, and the remainder by June, 1915.

Rochester.—Street Lighting.—The Gas Co. and the Kent Electric Power Co. are being asked by the Corporation to submit schemes and estimates for the lighting of High Street. Permission has been granted to the latter company to modify its experimental lamps in the High Street, in accordance with the experience gained, and to try them again for a short time before completing a scheme.

Scarborough.—Public E.L.—The Parks Committee has considered the advisability of lighting Peasholm Park by gas or electricity, and the borough engineer having submitted comparative tenders, it was resolved that the tender of Messrs. Walker and Hutton for E.L. be accepted.

Sheffield.—The City Council is being recommended to lay an E.H.T. main to supply the crippled children's institute and the proposed sanatorium for women in the Rivelin Valley Road, and a L.T. main for public lighting, at a total estimated cost of £3,940.

Southborough.—Proposed Bulk Supply.—The Tunbridge Wells T.C. has decided to inform the U.D.C. that, provided the permission of the B. of T. is secured, it is willing to afford a bulk supply of electricity on terms to be arranged.

Steyning (Sussex).—E.L. Scheme.—The electricity supply installed by Mr. E. Prior, of Burgess Hill, was switched on last week. About 30 consumers are being supplied. Steps are being taken to extend the supply to the villages of Bramber and Beeding.

Stockton.—Proposed Loan.—The T.C. is seeking sanction to borrow £2,000 for extensions to the electricity mains.

Stone (Staffs.).—Prov. Order.—The U.D.C. has offered to forego opposition to the Gas Co.'s Bill if the clause seeking powers for the supply of electricity is not proceeded with, as the Council intends applying for a prov. order for E.L. itself. The Gas Co. is to discuss the point raised with the Parliamentary agents.

Stratford-on-Avon.—The Stratford-on-Avon Electricity Co., Ltd., has secured the contract for the wiring of Alveston Manor. This old house, which has belonged to the Fortesques for many centuries, was built in the fifteenth century. It was in the main hall where Shakespeare was said to have been tried for poaching. The installation will comprise over 200 lights. Screwed tubing will be used throughout and the different circuits balanced on the three-wire system.

Street (Somerset).—Proposed E.L.—A meeting was held last week to consider a scheme for the formation of a company to provide an electric supply for the town. Messrs. C. and J. Clark, Ltd., boot manufacturers, convened the meeting, and in conjunction with Messrs. Cristy Bros., electrical engineers, of Chelmsford, have formulated a scheme to extend the boot factory plant by expending £4,000. Messrs. Clark are prepared to take 1,000 shares in the proposed company. A charge of 6d. a week for two lamps and 1d. each a week for extra lamps is suggested. A provisional committee has been appointed to report on the scheme.

Tasmania.—Mr. Parry, of the New Zealand Public Works Department, has been appointed to report on the Hydro-Electric Co.'s undertaking.

Taunton.—Mains Extensions.—The Electricity Committee has been authorised to lay another high-pressure feeder cable in the centre of the town, in consequence of the overloading of two other cables.

Torquay.—Proposed Loan.—The T.C. is applying to the L.G.B. for sanction to borrow £5,000 for mains extensions.

Tunbridge Wells.—Sewage Works.—The T.C. has instructed its electrical engineer to install electricity for lighting and power purposes at the North Sewage Farm.

Wakefield.—Loan Sanction.—The L.G.B. has sanctioned the borrowing of £13,000 for the extension of the electricity undertaking.

Application is to be made to the B. of T. for an order authorising the Corporation to supply electricity to Warmfield-cum Heath.

Walmer.—E.L. Bill Opposed.—The U.D.C. has sealed a petition against the Bill of the Gas Co., which seeks power to supply electricity in the district.

Walsall.—Proposed Loans.—The Electricity Committee of the Corporation recommends that application be made to the L.G.B. for sanction to borrow £2,092 for the purposes of the electricity undertaking, £1,092 for a chain-grate stoker and economiser, additions to sub-stations and new services, and £1,000 in respect of prospective expenditure on services. A successor to Mr. A. S. Barnard, borough electrical engineer, is to be advertised for at a commencing salary of £500 per annum.

West Ham.—Proposed Loan.—The T.C. proposes applying to the L.G.B. for sanction to borrow £3,085, the estimated excess expenditure which will be incurred on the generating station extensions and a further £3,261 for items required to complete the work.

Worcester.—Reduction in Rates.—The City Council has resolved to abolish the maximum demand system of charging for electricity, and to offer private consumers alternative charges of a flat rate of 4½d. per unit, or the "Norwich" system; and also to allow power consumers to use current for lighting purposes at power rates up to one-tenth of the quantity used for power purposes. The present M.D. rate is 6½d. and 3d. per unit for lighting and 2½d. and 1d. for power. The chairman of the Electricity Committee said the alteration would assure to the undertaking a certain fixed income and would give consumers current at a cheaper rate and induce them to use it for purposes other than lighting.

Wye (Kent).—Proposed E.L.—At a meeting of the East Ashford R.D.C. a letter was read from Mr. G. Stanton, of Whitstable, intimating that a company was prepared to provide a supply of electricity for Wye, a town in the Council's area, and asking for consent to the use of overhead wires. Several members spoke in favour of the project, and the matter was referred to the Highways Committee for consideration.

TRAMWAY and RAILWAY NOTES.

Blackpool.—Electric Time.—A scheme for the installation of a municipal time service, with a master clock at the Town Hall and synchronised dials at various points on the tramway routes, has been adopted by the T.C.

Continental.—Austria.—The companies interested in the scheme for the construction of an underground electric railway in Vienna will shortly submit proposals to the Municipal Council. It is expected that a period of five years will be required to complete the railway. The financial side of the question has yet to be settled. The French companies which are interested in the undertaking have been granted until the end of March to ascertain whether they will be able to float a loan in Paris to provide a portion of the capital. If, however, co-operation from this source should fail, it is said that the German and Austrian companies combined will be able to carry the scheme into effect.

Spain.—The horse tramway between Irun and Fuenterrabia is to be converted to electric traction.

Italy.—Referring to a note in this column (January 2nd), a correspondent of *L'Electricien* points out that the Italian Edison Co., in spite of its name, is really Italian; it owns almost the whole of the Milan tramways. The tramway companies of Turin and Genoa, on the other hand, though they have Italian names, are of foreign constitution.

The question of railway connection between Salsomaggiore and Borgo San Donnino and the junction of the latter with the State railway system is engaging Italian public attention. Both a steam tramway and a steam railway have been suggested; but in view of the difficulties associated with these solutions, preference has fallen upon an electric line, the plans of which have just been laid before the Government in connection with an application for a concession and subsidies. The proposed electric traction will allow of a reduction in fares and goods rates.

Germany.—The Prussian State Railways have already adopted electricity as the standard illuminant for all sleeping cars, and a recent official statement in the Reichstag indicates that all new passenger rolling stock is to be fitted with electric lighting.

Costa Rica.—The Governor of the Province of Lemon has entered into a contract with Messrs. R. M. Fernandez and T. Mangel, both of Lemon, for the construction of a tramway in the latter town. The motive power is to be either petrol, compressed air, or electricity, the gauge either 75 or 90 cm. (about 2 ft. 5½ in. or 2 ft. 11½ in.). The tramway is to extend beyond the town of Cunequeta, a distance of 1½ miles.

Croydon.—The B.C. is opposing the L.U. Tramways Bill, as the provisions may affect the interests of the B.C. in the South Metropolitan E.L. and Tramways Co.'s lines between Croydon, Tooting and Sutton.

Edinburgh.—Tramway Extension Delayed.—The Tramways Committee has passed a motion for the delay of the proposed prov. order for a system of self-propelled tramway cars to Corstorphine, on the ground that the route is already sufficiently served by motor-'buses.

Farnworth (near Bolton).—Proposed New Tramway.—The U.D.C. has appointed a deputation to interview the Salford Tramways Committee on the question of a connection between the existing tramways in Clifton and Pendlebury, so as to afford a through system from Bolton to Manchester.

Liverpool.—Annual Report.—The annual report states that the total revenue of the Corporation tramways department for 1913 amounted to £715,120, and operating costs (including rental of leased lines) to £451,667, leaving a gross profit of £263,453. This has been apportioned as follows:—Interest, £48,971; sinking fund and repayment of loans, £60,319; reserve, renewal, and depreciation account, £54,163; and contribution in aid of rates, £100,000. The net profit for the year amounted to £154,162, an increase of £20,304 over 1912. The contribution in relief of the rates is £33,071 in excess of last year's amount. The total sum set apart for sinking fund and redemption of debt is £1,091,771, and for reserve, renewal, and depreciation, £765,802. The number of passengers carried during the year was 144,085,927, an increase of 9,835,960 over 1912. The receipts in 1913 were £677,881, an increase of £46,810. Increased rates of pay to the tramway employés entailed an additional annual expenditure of £6,070.

London.—Marylebone.—With reference to a note published in this column on February 20th, on the authority of a financial daily, we understand that at last week's Council meeting it was stated in reply to a question by Mr. Duncan Watson that the Council had not purchased a 5-ton F.R.A.M. electric vehicle for refuse collection, nor could it be conceived how such a report had obtained currency.

Nelson.—Railless Traction Proposal.—The T.C. has instructed a Sub-Committee to report upon the powers necessary for the construction of overhead equipment, and the provision and working of a railless traction system.

Newcastle-on-Tyne.—Proposed New Cars.—The T.C. has decided to apply for sanction to borrow £12,240 for the purpose of acquiring 15 double-deck top-covered tramcars.

North-Eastern Railway Electrification.—Lord Knaresborough, chairman of the company, in addressing the shareholders at their annual meeting, alluded to the electrification of the mineral line from Shildon to Newport. The work, he said, was well in hand, and the first of the 10 electric locomotives almost completed. The working of freight traffic by electric locomotives was not entirely new to the company, but this was the first instance in which it had been tried upon anything like a comprehensive scale, and the experiment—for such it was—would be watched with the keenest interest. In view of its experimental nature, the directors had deemed it advisable to defray the whole cost, £150,000, out of current revenue, instead of debiting it to capital account. If the venture realised the expectations formed in regard to it, they would then be justified in charging a portion, if not the whole, of the cost to capital account.

South Shields.—Electric 'Buses.—The Tramways Committee has recommended the T.C. to purchase two Edison electric 'buses with motor-generator and switchgear, at a total cost of £2,594.

Rate Relief.—The Tramways Committee has granted £1,700 out of the tramway profits towards the rates. It was explained at a meeting of the T.C. that the estimated surplus of £7,000 was not profit, and the sum offered in aid of the rates was more than half of the real profit of the undertaking. The proposal to contribute to rate relief evoked considerable opposition, but was eventually carried.

Stockport.—The T.C. has decided to oppose the Manchester Corporation Bill, especially with reference to the clause relating to the running of motor-'buses over roads along which that Corporation already has running powers, and which include some in Stockport.

Stretford.—The Parliamentary Committee of the U.D.C. has declined the offer of the Manchester Corporation Tramways Committee to run a service of motor-'buses through the town in lieu of the tramways and light railways scheme authorised in 1903 and 1906.

Tyne Tunnel Scheme.—The Bill for the incorporation of a company to construct an electric railway under the Tyne, from South Shields to Tynemouth, has been withdrawn.

Walsall.—It has been decided to insert powers in the Corporation Bill for extending the proposed trolley vehicle route from Cannock as far as Hednesford, an additional distance of 2⅞ miles, involving further expenditure of £7,000.

TELEGRAPH and TELEPHONE NOTES.

Canada.—Statistics recently issued show that there is a telephone for every 15·2 people in Canada; there are 1,075 telephone organisations. The capital of the companies is placed at $59,847,004, equal to $129·13 per telephone. The cost of operation in 1913 was $24·10 per telephone.

It is the custom at the Windsor Street station, Montreal, of the Canadian-Pacific Railway, to announce the train departures by megaphone; recently a series of loud-speaking telephones actuated by one transmitter has been installed, to enable a person speaking in an ordinary tone to announce the departures in a stentorian voice at all parts of the station.

Germany.—Until recently it has not been possible to obtain satisfactory telephonic communication with Milan from places north of Frankfort, owing to inductive interference from overhead power wires in the Simplon Pass. These difficulties have now been so far overcome that the line is to be opened to the public as far as Berlin.

It is officially announced that the new Anglo-Belgian telephone cable will not be available for communication with Germany, but the German Post Office is not without hope of an ultimate connection which will pass direct from German to English soil without touching Holland, Belgium, or France. This would involve a submarine cable nearly 300 miles long.

Imperial Wireless System.—Replying to a question on Monday last, the Postmaster-General stated that the second three stations of the chain were included in the contract with the Marconi Co., but the Postmaster-General had power to cancel the contract so far as those stations were concerned. His predecessor advertised last November inviting applications for leave to tender for them from any who were able, by practical demonstration, to prove the efficiency of their system; replies were received from the Universal Radio Syndicate (Poulsen system), the Société Française Radioélectrique (Béthenod system) and the Galletti Co.

Their proposals, however, were too indefinite, and the dates suggested for the demonstrations were too distant to justify waiting for them. They were informed that the Post Office would be glad to witness demonstrations of the systems, but no demonstrations, even of an experimental character, had yet been given.

In the House of Lords last week, Lord Salisbury, on behalf of Lord Lansdowne, gave notice that on Monday the Leader of the Opposition would move the appointment of the following to form the Select Committee to inquire into the allegations concerning Lord Murray:—The Earl of Halsbury, Earl Loreburn, the Earl of Desart, Lord Charnwood and Lord Sanderson. On Monday the constitution of the Committee was agreed to. The first meeting will be held to-day.

Nigeria.—In a Colonial report on Southern Nigeria for 1912, it is stated that a consignment of 12,000 yards of river cable for the Niger River crossings was received, and upon being tested it was found that the insulation of the whole consignment was defective. After some difficulty it was eventually discovered that the ship in which the cable was originally shipped had been on fire, and the cable had been subsequently transferred to another vessel. There was no outward visible sign to show that the cable had been damaged, but the heat had evidently destroyed the insulation. A claim was submitted for the damaged cable and an order placed for a new consignment.—*Financial Times.*

Norway.—The municipal authorities have accepted a contract for the delivery of 440 KW. to the Stavanger Radio-station, which is now under construction for the trans-Atlantic service. Energy is to be delivered at a price of somewhat less than one-third of a penny per KW.-hour, and the minimum amount to be paid annually is £1,111. The contract is drawn for a period of 25 years, but the purchasers have the right of terminating it on giving three years' notice. The station will be completed in the course of the year.

The directors of the Bergen Telephone Co. are going to submit to the shareholders a proposal for increasing the capital by £33,333, in connection with an extension of the whole service. The company is going to spend nearly £40,000 on laying new cables, and a new exchange, which will involve a capital expenditure of £22,222, will be equipped with automatic apparatus at a cost of £35,000.

The Telephone Service.—In the course of a recent visit to Germany Mr. Hobhouse was shown a party-line telephone system which appeared to work satisfactorily; it was specially intended for use in rural districts, and was so devised, that although a number of subscribers were served by the same line, it was not possible for any one of them to overhear other subscribers on the line. In a statement to the Press Mr. Hobhouse said that he hoped it might be possible to adapt the system for use in this country, and thus to facilitate the adoption of the telephone in rural areas.

We understand that the system in question is that of the South German Telephone Apparatus, Cable and Wire Works A.G., of Nuremberg, for whom Messrs. W. F. Dennis & Co. are the sole agents in the United Kingdom. It is known as the "Steidle" semi-automatic telephone system, and is described in a brochure issued by Messrs. Dennis. The essential feature of the system is that when one subscriber is using the line no other subscriber can listen upon it, and it is not possible for one subscriber to monopolise the line, for if another subscriber is waiting to use it, the line is transferred to the latter directly the conversation in progress is finished.

These results are attained by simple means, involving only the provision of an auto-switchboard for each group of subscribers, numbering, say, five or 10, on one common double line. The subscriber first calls up the local exchange, the operator at which connects his line with that of any other subscriber in the same or a similar group by means of special selector switches, which call only the particular subscriber who is wanted. The completion of a conversation is automatically announced, enabling another subscriber to use the line. The chief saving is the reduction of the number of lines from the group to the local exchange, and the substitution of an automatic switchboard for a small sub-exchange, which would not provide adequate employment even for a single operator, and of course could not be kept open day and night on account of the expense entailed. Further particulars will be given in a later issue.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Newcastle.—April 29th. P.M.G. Electrically-controlled clocks at Post Office, Newcastle, N.S.W. Schedule No. 361. See "Official Notices" to-day.

Melbourne.—April 7th. P.M.G. Accumulator batteries for radio-telegraph stations. Relays, non-polarised. Stores Schedule 996. See "Official Notices" February 27th.

April 21st. P.M.G. Telephone switchboards. Schedule No. 1,005. See "Official Notices" to-day.

March 24th. P.M.G. Automatic switchboard apparatus for Geelong. Schedule No. 1,016. See "Official Notices" February 27th.

Adelaide.—April 8th. P.M.G. Switchboards, various. Schedule No. 315. See "Official Notices" February 27th.

Bedford.—April 1st. Corporation. 12 months' supply of high and low-tension cables; one-phase A.C. induction house service meters; metal-filament lamps. See "Official Notices" to-day.

Belfast.—March 16th. Corporation. Renewal and reconstruction of permanent way for 12 months, for the Tramways and Electricity Committee. Forms of tenders (£1 1s.) from the City Surveyor.

Belgium.—April 22nd. Municipal authorities of Montegnée (province of Liége). Concession for the supply of electrical energy for lighting and power purposes in the town, either by the establishment of a central station and network of mains, or by the supply from a neighbouring supply station.

Blackpool.—March 25th. Corporation. For the supply of six new open bogie cars for the Tramways Committee. Particulars from Mr. C. Furness, General Manager, General Offices, West Caroline Street.

Bray.—April 7th. U.D.C. General stores and stores for electric light works. See "Official Notices" to-day.

Burton-upon-Trent.—March 14th. Corporation. One 1,250-KW. three-phase turbine-alternator and condenser, pipe-work, valves and accessories. Extensions to high-tension switchboard. See "Official Notices" February 13th.

Canada.—March 28th. Electrical generating and distributing equipment, for the Regina Light and Power Department. Specifications from the Superintendent of the Department.

Cardiff.—March 18th. E.L. sundries for the City Mental Hospital, Whitchurch, for a year. Mr. T. D. Morgan, Clerk and Steward.

Darwen.—March 19th. Corporation. Brake blocks and castings. Town Clerk.

Dundee.—March 20th. T.C. For 12 months' supply of electrical stores, meters and carbons for the Electricity Department. Specifications from the Electricity Department, Dudhope Crescent Road.

Farnworth.—March 18th. U.D.C. 500-KW. rotary converter, transformer, switchgear and cables. See "Official Notices" March 6th.

France.—March 25th.—French State Railway authorities Bureau de Service Electrique (Ire Division), in Paris (43, Rue de Rome). Two high-tension multiphase cables to connect La Garenne and Suresnes-Puteaux sub-stations.

Guildford.—Three furnaces or mechanical stokers, for the Guildford Electricity Supply Co., Ltd. See "Official Notices" March 6th.

Hull.—March 20th. Corporation. Coal for 6 or 12 months, for the Property, Works, Tramways and Baths Committees. Forms of tender from the City Engineer.

Ilford.—March 14th. Stores for the tramways department of the U.D.C. for a year. Mr. L. E. Harvey, Tramways Manager, Ley Street.

Italy.—Rome.—April 15th. The Government of the Colony of Erythrea are prepared to receive tenders for a 15-year concession for the installation of an electric light system in the towns of Massana and Asmara. Cahier des charges, plans, &c., at the Ministry of the Colonies, Rome.

Kirkcaldy.—March 23rd. Corporation. Twelve months' supply of stores for the Electricity and Tramways Committee. Forms of tender from Mr. O. F. Francis, Burgh Electrical Engineer and Tramways Manager.

London.—L.C.C. March 18th. Electrical installation at the Upper Marylebone Street Elementary School, Gt. Portland Street, W. (148 points, 200 lights). See "Official Notices" Feb. 27th.

In connection with the scheme now before the Council for establishing a London ambulance service, it is proposed that the General Purposes Committee invite tenders for the supply of the ambulances.

LAMBETH.—March 17th. B. of G. Internal telephone system at the Infirmary, Brook Street, Kennington, S.E. See "Official Notices" March 6th.

WAR OFFICE.—Firms wishing to tender for supply of cables, electrical stores and scientific instruments should see a notice in our advertisement pages to-day. Application is not necessary from firms whose names are already on the War Office list.

Londonderry.—March 14th. Corporation. Meters and cables for the Electric Light Department. Specifications from the City Electrical Engineer.

Madeira.—Tenders will be received up to the end of March by the General Council of the District of Funchal, for a concession for the construction and working for a term of 75 years of an electric railway in the city and surrounding districts of Funchal. Deposit 10,000 scudi. Applications must be made in Portuguese.

Manchester.—March 17th. Corporation. (*a*) Tramway rail bonds, (*b*) hard drawn copper trolley wire (*c*), span wire brackets for tramway poles. Specifications for (*c*), 21s. (returnable) from Mr. G. M. McElroy, General Manager, 55, Piccadilly, Manchester.

March 18th. Education Committee. Electric lighting installation at Heald Place Municipal School, Rusholme. Specifications (£1 1s.) from the Secretary, Education Committee, Deansgate, Manchester.

New Zealand.—BOROUGH OF TAURANGA.—May 11th. Hydro-electric and sub-station plant. Specifications (£2 deposit) from H. W. Climie & Son.—*N.Z. Shipping and Commerce.*

Oldham.—March 23rd. Corporation. Steam, exhaust and drain pipes, condenser pipes, &c. See "Official Notices" to-day.

Newport (Mon.).—Wood-working machinery and engineers' machine tools, for the Corporation electricity and tramways department. Mr. A. Nichols Moore, Borough Electrical Engineer.

Plymouth.—March 19th. Corporation. Registering punches for tramways system. Town Clerk.

Rawtenstall.—March 23rd. Corporation. Boilers, superheaters, mechanical stokers, and steam piping, for the electricity works. Specification from Mr. C. L. E. Stewart, Electrical and Tramway Engineer, Electricity and Tramway's Offices, Bacup Road.

Russia.—May 14th. The municipality of Ekaterinoslav is open to receive tenders for the installation and working of a tramway in the city.

Sale. — U.D.C. Metal-filament lamps and paper-insulated and lead-covered cables for 12 months for Electricity Department. Specifications from Mr. C. J. Wood, Electricity Works, 4, School Road.

Salford.—March 23rd. Two high-tension distribution switchboards, for Park Lane sub-station, and twelve oil-switch cubicles for separate wall-mounting. See "Official Notices" March 6th.

March 23rd. Superheaters, pipes and valves. Specifications, &c., from the Borough Electrical Engineer, Frederick Road, Pendleton.

South Africa.— DURBAN. — Corporation. Two electrically-propelled aluminium-lined ambulances. London agents, Webster, Steel & Co. A copy of the specification can be seen at the Board of Trade Commercial Intelligence Department in London.

South Shields.—The Corporation is about to place an order for two Edison accumulator omnibuses with seating capacity of 23.

Spain.—April 16th. Municipal authorities of Aranjuez, Concession for the electric lighting of the town until the end of the year 1919.

Swansea.—March 13th. Corporation. Cable ducts, cables, pilot and telephone wires, joint-boxes, &c. See "Official Notices" February 27th.

Swindon.—March 18th. Corporation. Cooling tower. See "Official Notices" March 6th.

Swinton and Pendlebury.—March 26th. U.D.C. 12 months' supply of cable, joint-boxes, joint-box compound, bitumen, &c. See "Official Notices" March 6th.

Townhill (Dunfermline).—Doubling plant at Townhill Station of the Fife Electric Power Co. Secretary, Fife Electric Power Co., Townhill, Dunfermline, Fife.

Wallasey.—April 7th. Economisers, extra-high-tension cables, extra-high-tension switchboard, engines, alternators and condensers, hand-power overhead travelling crane, rotary converters, transformers, water-tube boilers, for the Borough Electricity Department. See "Official Notices" to-day.

Warrington.—March 14th. Corporation Gas Committee. Dynamo, 220 volts direct-current, 30 KW. Particulars from Mr. W. S. Haddock, General Manager, Gas Offices.

March 17th. Electricity Department. Tenders for scrap metals. Mr. F. V. Mathias, Electrical and Tramways Engineer.

March 31st. 750-KW. rotary converter, E.H.T. switchboard panel, for Electricity and Tramways Committee. See "Official Notices" March 6th.

Worle (Somerset).—March 19th. Street lighting for the Parish Council. Mr. Robert K. Clay, Clerk, Virginia Villa, Worle.

CLOSED.

Accrington.—The Corporation has purchased a 30-H.P. motor tower wagon from Messrs. Leyland Motors, Ltd., for use in the tramways department.

Australia.—NEW SOUTH WALES.—Postmaster-General's Department:—

3,000 transposition insulators, £189; 10,000 pattern "A" insulators, £296
25,000 pattern "B" ditto, £823.—Theodore Zwicker & Co.
3,200 C.B. wall pattern telephones, £6,000.—James Paton & Co.
21,000 steel spindles for use with various insulators, £433.—Williams and Co.
11,875 steel spindles for "B" insulators, £195.—Shaw Wireless, Ltd.

QUEENSLAND.—
800 strips protectors, £1,860; 200 ditto, £560; 3,000 double-pole protectors, £500.—Western Electric Co., (Aus.), Ltd.

N.S.W.—PUBLIC WORKS DEPARTMENT.—
For Homebush Abattoirs—Three-phase induction motors, £604.—Falkiner Electric Co.
Paper-insulated, lead-covered cable and accessories, £1,352.—W. T. Henley's Telegraph Co., Ltd.

CITY OF MELBOURNE.—
Bare hard-drawn copper cables, £450.—B.I. and Helsby Cables, Ltd.—*Tenders.*

BALMAIN.—Messrs. Johnson & Phillips, Ltd., through their Australian agents, have secured the contract for the supply of transformers.

Batley.—The T.C. has made contracts with the Brush Electrical Engineering Co., Ltd., for a 1,200-KW. Ljungström turbo-generator, and with the British Westinghouse Electric Co., Ltd., for rotary converters.

Bradford.—The Corporation Electricity Committee has accepted the following offers:—

Erection of a battery room at Valley Road electric works.—Thos. Obank and Sons, £344.
Constructional iron and steel work for the battery room.—Redpath, Brown and Co., Ltd., £659.

The Tramways Committee has accepted the tender of the North-Eastern Steel Co., Ltd., for 800 tons of steel girder tramway rails, at £6 6s. per ton; and that of Messrs. Thermit, Ltd., for 800 welding portions required for the welding of rail joints, at 19s. 6d. per portion.

Messrs. Tramways Supplies, Ltd., whose tender was accepted for trolley bases for trolley vehicle cars, having refused to sign the formal contract, the latter has been cancelled, and in lieu thereof the tender of Mr. C. H. Spencer to execute such work, at £370, is to be accepted.

Burton-on-Trent.—The following tenders have been accepted by the T.C. for the supply of coal to the electricity works:—

Marriott & Co.—3,000 tons Swadlincote and 1,000 tons Netherseal.
Salisbury & Wood.—1,000 tons Bretby and 1,000 tons Ibstock.
R. B. Barrett.—4,000 tons Kingsbury.

Bury.—The T.C. has sealed an agreement with Messrs. H. Lotery & Co. for the supply of tramwaymen's uniforms.

Canada.—WINNIPEG.—Messrs. Johnson & Phillips, Ltd., have secured the annual contract for the supply of three-phase transformers for the City of Winnipeg, through their Canadian agents.

Colchester.—The T.C. has accepted the tender of Messrs. Joslin, Ltd., of Colchester, for lighting, fittings, ironmongery, grease and oils for the tramways for a year; and that of Messrs. Williams & Co. for rubber and fibre.

Croydon.—Messrs. Siemens Bros. Dynamo Works, Ltd., have obtained a further contract for the annual supply of tantalum traction lamps for tram lighting, and "Wotan" drawn-wire lamps, for the county borough of Croydon.

Exeter.—The E.L. Committee recommends that the tender of the British Thomson-Houston Co. be accepted for a 1,000-KW. high-pressure steam turbo-alternator, at £4,211.

Ipswich.—The Corporation has placed the following contracts :—

Alternator, rotary converter, automatic voltage regulator and certain switchgear.—British Westinghouse Electric and Manufacturing Co., at £2,218.
Three 50-KW. transformers and a testing transformer.—Messrs. Ferranti, Ltd., at £194.
High and low-tension switchgear for main power station and sub-stations. —Voigt & Haeffner (England), Ltd., at £1,993.
Two rotary converters for Duke Street converter sub-station.—British Westinghouse Electric and Manufacturing Co., at £1,566.
High and low-tension underground cables. Secs. A and B.—Ateliers de Constructions Electrique du Nord et de l'Est (agents, W. H. Butler and Co.), at £6,158.
Fused mains disconnecting boxes for four-core three-phase L.T. distributors.—Messrs. W. Lucy & Co., of Oxford, at £196 (excluding fuses).
Service boxes.—The British Insulated and Helsby Cables, Ltd., Prescot, at £40.

London.—L.C.C.—The Stores and Contracts Committee recommends the acceptance of the following tenders for the supply of bitumen, pitch and green oil for the tramways department :—

Schedule No. 47, for the year ending December 31st, 1914.—E. Catchpole and Sons, Item 3 (one-half of estimated quantity); Forbes, Abbott and Lennard, Ltd., Item 2 (one-half of estimated quantity); Grindley and Co., Ltd., Items 2 and 3 (one-half of estimated quantity for each item); W. H. Keys, Ltd., Item 1.

The Highways Committee reports the receipt of the undermentioned tenders for 150 uninsulated trolley heads with booms, required in connection with the equipment of electric tramcars :—

Brecknell, Munro & Rogers, Ltd.	(accepted)	£195
British Westinghouse Co., Ltd.		195

The Committee accepted the tender indicated, as the firm are the actual manufacturers of the material, and their time of delivery is favourable.

The Committee has arranged for 100 car-sets of unbreakable grid rheostats, to be supplied by the makers, the Electro-Mechanical Brake Co., Ltd., for the tramways department.

The Education Committee has received the following tenders for installing electric light at the County Secondary School, Brockley :—

John C. Christie ..	(accepted) £552	C. Cathcart & Co.	£600
Arthur Newman, Ltd, ...	559	G. E. Taylor & Co... ..	688
Lund Bros. & Co.	565	G. Weston & Sons, Ltd. ..	690
W. Dickinson & Co., £907.			

The Metropolitan Water Board has accepted the tenders of Messrs. Buck & Hickman, at £147, for a motor-driven 8½-in. centre lathe ; and the Selson Engineering Co., Ltd., at £60 10s., for a motor-driven vertical pipe-drilling machine. The tenders of the Maxim Works, Ltd., and the B.I. and H. Cables, Ltd., have also been accepted for annual supplies of electric lamps, electric wire and accessories.

The tender of Messrs. Toy & Winslow has been accepted by the Metropolitan Asylums Board for an electric charging apparatus at the Mead Ambulance Station ; and that of Mr. H. J. Godfrey, at £68 10s., for an electric motor for driving a saw-bench.

CAMBERWELL.—The B.C. has accepted tenders for annual supplies of electric lamps from Cryselco, Ltd., Feld Bros. & Co., Ltd , and Brimsdown Lamp Works, Ltd.

HACKNEY.—The Electricity Committee reports that a further extension of the generating plant is necessary, and recommends that orders be given to Messrs. Willans & Robinson, Ltd., for a 5,000-KW. turbo-alternator, with condensing plant and accessories, at £13,500, and to Messrs. Ferranti. Ltd., for the necessary extensions of the switchgear, for £374 ; also that the pipework necessary be carried out as an extra to the contract with the Brightside Foundry and Engineering Co., Ltd.

WANDSWORTH.—The Guardians have accepted the tender of Messrs. Waygoods, at £94, for carrying out repairs to the two lifts at the St. John's Hill Infirmary.

L. & N.W. RAILWAY.—Messrs. Scholey & Co., Ltd., have received from the Maschinenfabrik Oerlikon an order for their special tool-steel gear wheels and pinions for the motor equipments to be used in the electrification scheme of the L. & N.W. Railway.

Manchester.—The Libraries Committee has accepted the tender of Messrs. Bertram Thomas for an electric lighting installation at the Chorlton-cum-Hardy branch library.

The Education Committee has accepted the tender of Messrs. W. P. Theermann & Co., Ltd., for an electric lighting installation at the North Manchester Secondary School.

The following tenders have been accepted by the Electricity Committee :—

Babcock & Wilcox, Ltd.—Two water-tube boilers and induced-draught plant at Stuart Street.
Lancashire Water Cooler Co.—Water cooler at Stuart Street station.
Edison & Swan Co., Ltd.—High and low-tension switchgear at Dickinson Street.
Crompton & Co., Ltd.—Balancing plant.
Vaughan & Son, Ltd.—7½ tons overhead travelling crane.
British Westinghouse Electric Co., Ltd., Electric Construction Co., Ltd., and Ferguson, Pailin & Co.—High and low-tension switchgear for sub-stations.
B.I. & Helsby Cables, Ltd., Johnson & Phillips, Ltd., Connolly Bros., Ltd., Chas. Macintosh & Co., Ltd., and Electrical Engineering and Equipment Co., Ltd.—Supplies of cable.

Middleton.—The tenders of Messrs. John Hulbert and C. B. Lockwood, for coal for the electricity works for 12 months, have been accepted.

Nelson.—The T.C. has accepted the tender of Mr. B. Schabatt for wiring the new Council Offices.

Newcastle-on-Tyne.—The City Council, on 4th inst., sealed a contract with Messrs. C. A. Parsons & Co., Ltd., for the supply of a duplicate turbine for Manors power station, at £8 170.

Newport (Mon.).—The B. of G. on Saturday accepted the tender of Messrs. R. Alger & Sons, of Newport, for E.L. fittings for a year.

Scarborough.—The T.C. North Side Sub-committee has accepted the tender of Messrs. Walker & Hutton for the lighting of Peasholm Park by electricity.

The Brightside Foundry and Engineering Co., Ltd., have secured the contract for a complete electric lighting equipment for Scarborough workhouse and infirmary.

Sheffield.—The following tenders have been accepted by the City Council :—

Gilbert, Heathcote & Co.—Constructional steelwork for extensions to the boiler house at the electricity works, £12,850.
Wellerman Bros., Ltd.—Additions to transformer sub-stations.
Wolseley Car Co.—One four-cylinder motor-wagon for the Electricity Department, £550.
T. A. Ashton, Ltd.—Wiring the Attercliffe baths, £128.
Electric Construction Co., Ltd.—Three feeder panels, £149.
Stirling Boiler Co., Ltd.—Retubing two Stirling boilers at Kelham Island power station, £703; two superheaters, £320.

The following tenders have also been accepted for annual supplies :—

Electrical fittings.—Marsh Bros. ; Tasker, Sons & Co. ; Makin & Co., Ltd. ; Ediswan Co., Ltd. ; Renton, Holdsworth & Co. ; T. A. Ashton, Ltd. ; General Electric Co., Ltd. ; L.-R., G.-P. and T. Works Co. ; Hallamshire Electric Co., Ltd. ; David Ashton & Co., Ltd.

South Shields.—The Corporation has accepted the tender of Edison Accumulators, Ltd., for the supply of two electric motor-omnibuses for the Tramways Committee.

Walsall.—The following tenders have been accepted by the T.C. :—

Ferranti, Ltd.—150-K.V.A. transformer, £112.
Walsall Electrical Co.—Switchgear, £50.
General Electric Co.—Meter, £20.

West Ham.—The T.C. has extended the contract of the British Westinghouse Co. for transformers for a further two years as from April 1st next, the prices to be as at present, but subject to a discount of 2½ per cent. This will mean a net reduction of 2½ per cent. on the present contract, the credit also being extended from 7 to 30 days. The Council's contract with the Fuller Electrical Co., Ltd., is also to be extended for a further year on the basis of an advance of 15 per cent. on the present contract prices. The following tenders have been accepted for annual supplies :—

Electrical fittings and accessories.—Davies, Kent & Stewart ; J. H. Tucker and Co. ; Baxter & Caunter ; Falk, Stadelmann & Co., Ltd. ; Feld Bros. & Co., Ltd. ; Edison & Swan Co. ; J. & H. Grevener ; E. Dewhurst ; General Electric Co., Ltd.
Insulated wires and cables.—Gillespie & Beales ; Armorduct Manufacturing Co.

Wolverhampton.—The T.C. has accepted the tender of Messrs. W. Hayward & Sons, at £1,012, for steel work and bunkers for the boiler house extension, and that of the United Electric Car Co., Ltd., for fixing six additional top-covers to cars, at £101 each. The reciprocating engine plant is to be repaired by Messrs. Bellis and Morcom, Ltd., at £95.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week :—

Monday, March 16th.—"A" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.
Tuesday, March 17th.—"B" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.
Wednesday, March 18th.—All Companies. Rating examination, 7 to 10 p.m.
Thursday, March 19th.—"C" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.
Friday, March 20th.—"D" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.
Saturday, March 21st.—Headquarters will be opened for regimental business from 10 a.m. till 12 noon.

(Signed) F. R. HOLT-WHITE, Capt. R.E., Adjutant.
For Officer commanding L.E.E.

Copper.—The visible supply bears up bravely against demand, although, of course, the real test of its extent will come when the present unpleasant problems influencing all securities are a little more advanced towards solution. For the end of February, Messrs. Merton's circular shows English stocks of 10,399 tons, a decrease of only 20 tons on the figure for the end of January. The total visible supplies for Europe are given as 26,953 tons, an increase of 1,109 tons for the month. Demand has been quite unusually brisk, total deliveries being 52,390 tons. European arrivals from America have been considerable, 38,655 tons, against an average for the 12 months of 33,000 odd. Spain and Portugal are also strong, though small in actual quantity. Chilian and Australian shipments are—the former slightly below the average, the latter just over. American stocks lost 1,850 tons during January, and at the end of the month the world's supply showed 5,426 less than for the end of last year.

FORTHCOMING EVENTS.

Physical Society of London.—Friday, March 13th. At 8 p.m. At Imperial College of Science, South Kensington. Ordinary meeting. Papers on "Time Measurements of Magnetic Disturbances and their Interpretations," by Dr. C. Chree, F.R.S.; "The Asymmetric Distribution of the Secondary Electronic Radiation produced by X-Radiation," by Mr. A. J. Philpot.

Manchester Association of Engineers.—Saturday, March 14th. At Grand Hotel, Aytoun Street. Topical Discussion Evening.

Institute of Marine Engineers.—Monday, March 16th. At 8 p.m. Discussion or Fuel Test.

Junior Institution of Engineers.—Monday, March 16th. At 8 p.m. At Institution of Electrical Engineers, Victoria Embankment. Paper on "Some Practical Notes on the Running of Gas Engines and Gas Producers," by Mr. W. A. Tookey.

Friday, March 20th. At 8 p.m. At 39, Victoria Street. Paper on "Aeroplanes as Engineering Structures," by Mr. W. H. Sayers.

(North-Western Section).—Friday, March 20th. At 7.45 p.m. At Municipal School of Technology. Mr. Tookey's paper.

Royal Society of Arts.—Monday, March 16th. At 8 p.m. At John Street, Adelphi. Howard Lecture on "Surface Combustion," by Prof. W. A. Bone, F.R.S.

Illuminating Engineering Society.—Tuesday, March 17th. At 8 p.m. At House of Royal Society of Arts, John Street, Adelphi. Paper on "A Comparison between Illumination Estimates and Performance in Practice," by Mr. W. C. Clinton.

Institution of Civil Engineers.—Tuesday, March 17th. At 8 p.m. At Great George Street, S.W. Discussion on following papers to be concluded:—"Rail-Steels for Electric Railways," and "Rail-Corrugation and its Causes." And papers to be read:—"Some Recent Developments in Commercial Motor-Vehicles," by Mr. T. Clarkson; and "Comparative Economics of Tramways and Railless Electric Traction," by Mr. T. G. Gribble.

Institution of Engineers and Shipbuilders in Scotland.—Tuesday, March 17th. At 8 p.m. At Rankine Hall, 39, Elmbank Crescent, Glasgow. Ordinary meeting.

Electrical Trades Benevolent Institution.—Wednesday, March 18th. At 2.30 p.m. At Institution of Electrical Engineers, Victoria Embankment. Annual general meeting.

Chemical Society.—Thursday, March 19th. At 8.30 p.m. At Burlington House. Paper on "The Ignition of some Gaseous Mixtures by the Electric Discharge," by Messrs. H. F. Coward, C. Cooper and J. Jacobs.

Institution of Electrical Engineers.—Thursday, March 19th. At 8 p.m. At Victoria Embankment. Discussion on "Electric Battery Vehicles."

(Newcastle Local Section).—Monday, March 16th. At 7.30 p.m. At Armstrong College. Demonstration of Electrical Measuring Instruments, by Mr. Fawssett and Dr. H. Stroud.

(Western Local Section).—Monday, March 16th. At 2 p.m.: Visit to Messrs. E. S. & A. Robinson, Ltd., Malago Factory. At 4.30 p.m.: Annual meeting at the Merchant Venturers' Technical College. At 5 p.m.: Paper on "The Construction of a Wireless Station," by Mr. C. G. Roach.

(Manchester Students' Section).—Tuesday, March 17th. At 7.30 p.m. At Municipal School of Technology. Paper on "Diseases of Static Transformers," by Mr. J. L. Thompson.

(Students' Section).—Wednesday, March 18th. At 7.45 p.m. Paper on "Electricity in Docks and Harbours," by Mr. J. M. Heslop.

Royal Institution of Great Britain.—Thursday, March 19th. At 3 p.m. At Albemarle Street, W. Paper on "Heat and Cold," by Prof. C. F. Jenkin.

Friday, March 20th. At 9 p.m. Paper on "Fluid Motions," by Lord Rayleigh, F.R.S.

Saturday, March 21st. At 3 p.m. Paper on "Recent Discoveries in Physical Science," by Prof. Sir J. J. Thomson, F.R.S.

Institution of Mechanical Engineers.—Friday, March 20th. At 8 p.m. At Storey's Gate, S.W. Paper on "The Chemical and Mechanical Relations of Iron, Tungsten, and Carbon, and of Iron, Nickel and Carbon," by Dr. J. O. Arnold, F.R.S., and Mr. A. A. Read.

Electro-Harmonic Society.—Friday, March 20th. At 8 p.m. At Holborn Restaurant. Smoking Concert.

Greenock Electrical Society.—Friday, March 20th. At 7.45 p.m. At Temperance Institute, West Stewart Street. Paper on "Sub-station Equipment," by Mr. D. McDougall.

Association of Mining Electrical Engineers.—Friday, March 20th. At 7.30 p.m. At Royal Technical College, Glasgow. Paper on "Rock Drills," by Mr. C. E. Hart.

Association of Engineers-in-Charge.—Saturday, March 21st. Annual Dinner.

NOTES.

Technical Education in Australia.—An Australian paper states that one of the main features of the reorganised scheme of technical education brought about by the institution of trade schools is the creation of advisory committees, the members of which are to be appointed for two years. The functions of these advisory committees are to make suggestions as to the suitability and scope of the syllabus of instruction, to visit the classes periodically, to advise as to the efficiency of the teaching appliances, and to assist in awarding the certificates. The Electrical Engineering Trades Advisory Committee will consist of one member nominated by the Electrical Engineering Association; five from the Electrical Trades Union of N.S.W.; the Electrical Engineer, City Municipal Council; the Electrical Engineer, N.S.W. Government Tramways; Messrs. J. E. Donohoe, manager of the Electric Light and Power Supply Co., Ltd., T. Thompson-Bower, A. J. Hanson, F. O'Donnell, Allen Warburton and A. E. Waddell.

The Electric Vehicle Association of America.—Owing to the marked growth of the activities of the Electric Vehicle Association of America, it has been found necessary to establish the office of permanent executive secretary. Mr. A. J. Marshall has been selected to fill the new appointment, and the permanent offices of the Association have been located in the New York Engineering Societies' Building, Thirty-Ninth Street, New York.

An All-Electric Colliery.—In the *Daily Mail* of Wednesday last there was an interesting article by Mr. Basil Clarke on the reopening of Lostock Lane Pit; this pit was closed owing to unprofitable working, but has been equipped throughout with electrical machinery, including winding plant, and is now running successfully at twice its former output. The pit is the first in Lancashire to be worked entirely by electrical energy, which is supplied by the Lancashire Electric Power Co.

A South Metropolitan Electrical Exhibition.—There was opened yesterday, at the showrooms of the South Metropolitan Electric Light and Power Co., Ltd., 181/185, High Street, Lewisham, an Electrical Exhibition, which it is hoped every resident in the neighbourhood will attend, whether he be or be not one of the 12,000 to whom invitation cards have been sent. A varied collection of apparatus is admirably arranged to demonstrate the advantages and flexibility of electric lighting and to illustrate the applications of electricity in other fields. The Exhibition will be closed on March 21st, unless circumstances justify its being kept open longer. The permanent showroom contains a comprehensive selection of the latest types of lighting fittings and accessories; electrically-heated kettles, toasters, saucepans, porringers and other kitchen and dining-room cooking and heating appliances, including "Tricity" and "Eclipse" ovens, and a variety of electric radiators and convectors. Among the latter is a heater controlled on the Grundy thermostat system, so that the heating elements are switched out of circuit when the room temperature reaches a predetermined limit; 40 of these heaters have recently been installed in a local picture palace, and a large number are in use in offices, &c. All the hot water required on the company's premises is provided by a "Therol" heater in the showroom, and the offices are heated by radiators and Belling fires. Among the innumerable devices exhibited are electric hat pads and irons, cigar lighters, displacement and high-vacuum suction cleaners, bachelors' grills, sterilisers, fans, ozone apparatus, vibrators, hot-air douches and an electric fountain. The lamp and lighting exhibits include Osram axial lamps, screw socket miniature lamps for "chain" decorations, half-watt "Wotan" lamps, and a demonstration board showing the stages of lamp manufacture. Other demonstration boards show wiring conductors and accessories, and a special exhibit has been arranged to educate the public in the magnitude of the work undertaken by the company in generating and distributing electrical energy. An electrically-driven sewing machine is exhibited, such as is used industrially in large numbers in this district; and an electrically-driven hack-saw demonstrates one of the many applications for electricity in small workshops. Special temporary exhibits include an electric bedroom and dining room. The arrangement and equipment of these rooms are really fine, and no more convincing demonstration of the applications, merits and convenience of electricity could be desired. Prospective purchasers will find that they are not restricted in choice, and thoroughly sound advice is given concerning the relative merits of various apparatus for particular services. The price of everything shown is right, and the company makes special arrangements for cash or hire-purchase, or mere renting of wiring and apparatus. A new scheme has just been inaugurated, under which the company wires a house for nine lighting points and provides everything complete, including fittings, lamps, shades and switches, &c., free of cost. If the consumer is dissatisfied at the end of three months, the gas lighting equipment will be replaced free of charge. Otherwise, the client may buy the electrical equipment (by cash or hire-purchase), or he may rent it at 4½d. per week. Competition with the South Metropolitan Gas Co. is especially keen, but during last year the Electric Co. established a record increase in consumers, lamps and net revenue (the latter has increased 50 per cent. during the last three years), and doubtless yet more rapid progress will be the reward of their present campaign. Houses of £26 per annum, or even lower rental, are being "electrified" by streets at a time, prepayment meters being very popular in this field since their use eliminates specific meter rents. Among the smaller electric heating appliances, irons, milk heaters and kettles are most popular. Individually the present exhibits represent the latest and best domestic electric fittings and appliances, and, as a whole, they are arranged to produce a most artistic effect—which is not, unfortunately, always the case in showrooms. To the good effect produced by the exhibits are added interesting and instructive periodical addresses, music and electric refreshments. Subsequently, there comes into operation a first-class publicity and canvassing service, in the case of residents in the district. The company is to be congratulated, not only on the excellence of the present Exhibition, but also on the energetic and effective means which it adopts continuously to refute the absurd fallacy that electricity is still in its infancy and to demonstrate that electrical methods and apparatus are well tried and have attained a perfection of manufacture and diversity of standard forms, which make them neither scientific curiosities, luxuries nor toys, but necessities capable of rendering real service at a cost which is decreasing steadily, while that of practically every other commodity increases.

Foreign Trade in February.—The following are the electrical and machinery figures given in the official returns for February trade:—

Imports.	*Month of Feb.*	*Inc. or dec.*	*Two months, 1914.*	*Inc. or dec.*
	£	£	£	£
Electrical goods and apparatus, excluding machinery and uninsulated wire ...	143,200	+ 22,243	281,711	+ 24,562
Machinery	643,877	+123,654	1,243,268	+ 49,318
Exports.				
Electrical goods and apparatus, excluding machinery and unsulated wire ...	258,218	— 97,747	511,939	—212,644
Machinery	3,033,614	+320,985	6,421,349	+596,246

The Norwegian Electrochemical Export Trade in 1913.—Our Special Correspondent writes that the electrochemical industry in Norway has during recent years made progress which is quite unprecedented in the history of any country, in proportion to the population, and will very likely in a few years become one of the most important factors of the political-social economy of the country. The most important manufactures are now the nitrates, and Norwegian nitrates are already a well-known brand in the world's markets. The exports are increasing from year to year, and will no doubt continue to do so in the same ratio as the waterfalls are being harnessed and brought into use. The quantity of nitrates shipped from the manufactories at Saaheim and Notodden amounted in 1913 to 70,171 tons, as compared with 51,701 tons in 1912. There is thus an increase of about 40 per cent. in weight, and the value has increased about 35 per cent. The value of the exports was in 1913 £611,100, as against £450,000 in 1912, while 1911 had only the very modest figure of £77,800 to show.

Another product also used for fertilising purposes is cyanamide which at the present time is manufactured at Odda, in Hardanger. The shipments of this product show a similar progress; thus in 1913 there were exported 22,111 tons, as compared with 13,892 tons in 1912, an increase of about 60 per cent. On the basis of the same market price as in 1912, the value of the exports amounted in 1913 to nearly £200,000, which compares very favourably with the corresponding figure for 1910, when this industry was in its early stages, which was £38,000.

As regards calcium carbide, the shipments show a small increase, viz., from 63,100 tons in 1912 to 66,876 tons in 1913. The value was about the same as that of the nitrates in 1912, viz., £450,000, but in 1913 the nitrates took the lead as the most valuable electrochemical product exported.

Of other products may be mentioned sodium nitride, ammonium nitrate and nitrate of soda, of which the total shipments during 1913 amounted to 17,028 tons, as against 13,480 tons in 1912. The electro-chemical industry is thus making good progress in every direction, and the time is quite within sight when these figures, at all events in respect of value, will have grown by 100-200 per cent., or even more. The Rjukan Nitrate Works No. 2 will be in operation in the course of next year, and when the Matre Waterfalls, not to speak of the large plants of the Aura Co., which are to be compared with those at Saaheim in regard to capacity, are completed, it is easy to understand that the above-mentioned expectations will be verified.

The increasing demand for artificial manures does not give this industry any opportunity for over-production. The market prices are still based on the quotations for the natural nitrates from Chile, although a change may easily take place, and the product from Chile become dependent on the artificial nitrates.

Electricity in Agriculture.—Particulars were given last month before an Agricultural Committee of the House of Commons, Ottawa, of the manner in which electrical power is being supplied to farmers by the Hydroelectric Commission of Ontario. The Commission builds the line to the farmer's gate, and charges him for the energy supplied, as well as a "service charge." It has been shown that a 5-H.P. equipment can do all the work of a 100-acre farm. The minimum contract is for ½ H.P., at $51 per annum; 1 H.P. costs $66; and 2 H.P. $96. About 500 farmers are connected in Western Ontario.

Electro-Harmonic Society.—The last smoking concert of the season will be held at the Holborn Restaurant (King's Hall) on Friday evening next, March 20th, at 8 o'clock. Mr. Justus Eck will be in the chair. The programme includes the following arrangements:—Vocalists, Mr. Robert Radford (baritone), Mr. Robert Howe (baritone), Mr. Anderson Nicol (tenor); violoncello, Mr. W. H. Squire; impressions from life, Mr. H. Hewson-Brown; magician, Prof. Anders; ventriloquist, Mr. Alan Stainer; humorists, Mr. Fred Curtis and Mr. George Blackmore; entertainer at the piano, Mr. Warwick Pryce; solo pianist and accompanist, Mr. Bernard Flanders, A.R.A.M.

German Miners' Lamp Competition.—No fewer than 52 entries were received for the competition recently organised by the Verein fur den Bergbaulichen Interessen in Oberbergamtsbezirk Dortmund for miners' electric lamps and fire-damp indicators. Although a number have already been eliminated by the preliminary tests that have been held, it has been decided that practical trials in collieries will have to be carried out with the remainder, so that the judges' awards cannot be expected for some time to come.

Educational Notes.—The London County Council having failed to provide a larger grant for science classes, asked for by the University of London, the evening classes at Goldsmiths' College, New Cross (one of the colleges of the University), have been closed, and some of the staff have left. The students have appealed to the Deptford Borough Council for its intervention.

Dinners.—About 35 members of the staff of the British Insulated and Helsby Cables, Ltd., Helsby Works, attended the annual staff dinner at the Hotel St. George, Liverpool, recently, and afterwards spent the evening at the Empire Theatre.

British Engineers' Association.—The annual dinner of this Association was held on Friday last at the Hotel Metropole, Mr. Douglas Vickers in the chair.

Inquiry.—Makers of "Kenrick" electric irons are asked for.

Institution and Lecture Notes.—Association of Electrical Station Engineers.—A general meeting was held at Stone's Restaurant, Ludgate Hill, London, E.C., on March 3rd. The attendance numbered about 60. A definite statement was made dissociating the A.E.S.E. from any Trade Union, and, after a short discussion, a resolution was put to the meeting confirming this statement, which was carried with one dissentient. A bad case of reduced salaries of the charge engineers in a large private power station was brought to the notice of the meeting, and it was resolved that all members of the Association be circularised with the facts of the case. The Weekly Rest Day Bill, which is to be re-introduced into Parliament next May, was discussed, and some comment was made on the clause which would make it compulsory for all workers to have 26 Sundays per year as rest days. The Hon. Secretary made a brief statement with regard to the circular letter sent to all London supply authorities asking them to consider the advisability of forming a committee to meet the A.E.S.E.; he stated that more than 75 per cent. of those who were circularised had acknowledged the letter, and a number of chief engineers had indicated that they were in sympathy with the objects of the A.E.S.E. The Secretary hoped to be able to make a further statement at the next general meeting.

The result of the ballot for the new London District Committee was made known to the meeting.

A general business meeting was held recently at the Hotspur Hotel, Newcastle-on-Tyne, at which 40 members were present. The meeting indicated that it viewed with satisfaction the policy of the A.E.S.E. in that it would not take action with any Trade Union. This policy has now been agreed to by the majority of the branches of the Association.

An Executive Committee meeting was held at the head office of the A.E.S.E. on March 7th, the proceedings of which will be printed and sent to each member in due course according to rule.

Nottingham Society of Engineers.—A company numbering nearly 100 assembled for the annual dinner of the Society on Friday last; Mr. J. Crawford, the President, occupied the chair. The toast of "The Society" was proposed by Mr. T. V. Miles, who described the present as essentially the age of the engineer. The labour-saving problem was one they would all have to consider within the next few years. The President, replying, spoke with feelings of pride of the healthy position of the Society. He agreed that if engineers, by the expenditure of money upon plans and machinery, could do anything to obviate the exhausting, and in many cases unnecessary, physical labour which many men were called upon to perform in this country they would only be doing their duty to the community at large. The labour unrest was merely a sign in many ways of personal ambition. They were all anxious to get on, and surely they were not going to deny to the working man that right which they claimed for themselves. He was sorry to say that at the present time engineering, as a whole, was not prosperous, but he hoped that things would not develop into a slump.

Mr. C. J. Hofton proposed "The City and Trade of Nottingham." Many of those present, he said, had witnessed the remarkable growth that had taken place in recent years in Nottingham, and yet they were not satisfied. He suggested to the Corporation the importance of endeavouring to attract new industries to the city, and pointed out the excellent work in that direction accomplished by the town of Derby.

Councillor Major Walker, in reply, said that as regarded new industries, they had greater difficulties to contend with than had their neighbours at Derby. Rates were higher, and high rates were an obstacle to the introduction of new industries. Moreover, he did not think any city or county paid higher wages than did Nottingham and Notts., and this, combined with high rates, tended to keep away new trades. If the Government could only be induced to take over and develop the waterways of the country, he believed it would do something to assist new trades, and Nottingham would be one of the principal cities to be benefited.

The speeches were interspersed with glees and songs, some well-known local vocalists contributing to the programme.

Institution of Electrical Engineers.—At the meeting of the Manchester Local Section on Tuesday last, Mr. F. Lydall read his paper on "Motor and Control Equipments for Electric Locomotives." The discussion was closed.

The Electrical Contractors' Association of Scotland (Glasgow Branch) recently held an "At Home," spending a pleasant evening at whist, enlivened with a musical programme.

Association of Mining Electrical Engineers.—Mr. Alex. Anderson, president of the Association, read a paper on "Electrical Transmission in Mines," at Leeds, on Saturday, before a joint meeting of the Yorkshire branches of the Association of Colliery Managers and the Association of Mining Electrical Engineers.

Greenock Electrical Society.—At a recent meeting a paper on "Power Transmission" was read by Mr. A. Zoller, in which he dealt with the advantages and disadvantages of overhead and underground cables for high-tension transmission.

At the meeting of the Yorkshire Local Section, on Wednesday last, Mr. H. H. Perry read his paper on "A Two-Rate Tariff System without Time-Operated Control." The discussion was closed.

The Reichsanstalt Extended.—A new building, costing £38,000, was opened at the Physikalisch-Technische Reichsanstalt, in Charlottenburg, on March 8th. It is to undertake the accurate testing of large plant and machines, and also high-tension work.

Tuberculosis and X-Rays.—Dr. Manoukhin, of St. Petersburg, recently stated that he had attained remarkable results in the treatment of tuberculosis by X-ray radiation of the spleen, the effect being to destroy the excessive number of white blood corpuscles, which are formed in that body.

A Discount Dispute.—Before Mr. Registrar Wild, in the City of London Court, on Tuesday, a claim was made by Messrs. G. Weston & Son, electrical engineers, 153, Fenchurch Street, E.C., for the sum of 19s. 3d., balance of account for electrical fittings supplied, and work done, for Mr. P. Leapman, pawnbroker, 789, Commercial Road, E. The plaintiffs' representative said that the defendant had made a deduction of 10 per cent. discount from the account to which he was not entitled. The discount was only allowable upon payment of the account immediately after completion of the work. The defendant did not pay until four months after. The defendant: Will you tell the Registrar why you did not get your cheque? The plaintiffs' representative said they agreed to allow the defendant 10 per cent. if he paid at once upon completion. They had completed the work in September. The defendant: No, you did not. The plaintiffs' representative said that after the work was done the defendant maintained they had damaged the ceiling. It was a very old ceiling and would not bear touching without some of it falling down. For that reason the defendant refused to pay his cheque. They had repaired the ceiling since without prejudice. The Registrar pointed out to the defendant that he might have a counterclaim for damage done to his ceiling, but that was the subject of another claim. He had entered into a contract for the work in that case to be done, and on completion if he paid he was to get 10 per cent. If the defendant wanted his discount he must pay the account. The defendant, in order to save the discount, must keep within the terms of the contract. Judgment was entered for the plaintiffs for the amount claimed, the Registrar remarking that the defendant could bring his action against the plaintiffs for the damage to the ceiling. The defendant: All right, I will, and I will bring it in this Court. They have put up a matchboard ceiling instead of a plaster one.

Parliamentary.—London Electric Supply Bill.—It was announced in the newspapers on Tuesday that a conference of chairmen and directors of the London Electric Supply Companies was held on the 3rd inst., when it was resolved by a large majority that the companies could not give their support to the scheme put forward by the promoters in connection with the London Electric Supply Bill now before Parliament.

In the above connection we are asked to point out that such notices tend to mislead in so far that the companies (*i.e.*, the shareholders) have not come to any decision on the question for the reason that the scheme has not yet been put before them. At none of the annual meetings yet held has any vote or resolution been taken, but the chairmen have indicated that the shareholders may anticipate that the scheme will shortly be laid before them. It is stated that since the above shareholders' meetings, no further conference has taken place between the directors of the companies and the bankers. From observations made by Mr. J. B. Braithwaite at the meeting of the City Co. on Wednesday, it appears that there is a difference of opinion among the directors of the companies themselves.

Yorkshire Electric Power Bill.—The House of Lords' Standing Orders Committee have decided not to dispense with the Standing Orders in the Yorkshire Electric Power Co.'s Bill; and consequently the Bill cannot proceed.

In the House of Lords, on 3rd inst., the North Metropolitan Electric Power Supply Bill, and the Poole, Sandbanks and Westbourne Railless Traction Bill, were read a second time.

Marconis Again.—Another Committee of Inquiry has been appointed.

As if, by the thickening
Of all that is sickening
We hadn't been sated
Of this long ago!
Another Committee,
Without any pity,
Will soon, it is stated,
Be all in the know.
A plague on Marconis,
Whatever the bone is
Of endless contention
They're trying to pick!
The subject is dreary;
Our minds have grown weary;
And nothing they mention
Can make us more sick!

—*Financial Times.*

The Tramways and Light Railways Association.—The annual meeting of the members of this Association was held on Friday last, followed by the annual dinner and smoking concert, at the Trocadero Restaurant, London. The Hon. Arthur Stanley, M.P., presided at the meeting, and the Right Hon. Viscount Chilston, president of the Association, took the chair at the dinner.

Finsbury O.S.A.—The eighth annual smoking concert of the Finsbury Technical College Old Students' Association is to be held at the Waldorf Hotel, Aldwych, on Friday, March 27th, at 8 p.m. The musical programme has been arranged by Mr. C. B. Nadand, A.M.I.E.E. Mr. H. A. Humphrey, the president, will take the chair.

For Sale.—A large quantity of electrical apparatus, &c., is to be sold by public auction, by Messrs. Percy Huddleston & Co., at Railway Arches, Dalling Road, Hammersmith, W., on Wednesday, March 8th. Particulars are given in our advertisement pages to-day.

Platinum.—It is reported that an extensive field of platinum-bearing ore has been discovered in Westphalia, richer than the Russian deposits. Doubt is thrown on the report on the London metal market.

Radiotelegraphy and the Solar Eclipse.—The British Association Committee for radiotelegraphic investigation announces the organisation of a special investigation into the effect on the propagation of electric waves of the total eclipse of the sun, on August 21st, 1914. The eclipse will afford an exceptional opportunity of adding to existing knowledge of the propagation of electric waves through air in sunlight and in darkness, and across the boundaries of illuminated and unilluminated regions. The eclipse will be total along a strip extending from Greenland across Norway, Sweden, Russia and Persia to the mouths of the Indus. In Russia the duration of totality will be a little more than two minutes. There are two main points calling for investigation. In the first place, the propagation of signal-bearing waves through air in the umbra and penumbra will probably obey laws different as regards absorption and refraction from those obeyed in illuminated air. In the second place, the strength, frequency and character of natural electric waves, and of atmospheric discharges, may vary, either because the propagation of natural waves from distant sources is facilitated or impeded by the eclipse, or, possibly, because the production of natural electric waves or atmospheric discharges is for some unknown reason affected by the eclipse. These points have previously been investigated to only a slight extent. The observers of signals during the solar eclipse of April 17th, 1912, nearly all agreed that the strength of the signals was greater during the eclipse than an hour before or after. There was only one special observation of strays during the same eclipse, when very pronounced and remarkable variations were recorded during the passage of the shadow-cone across Europe. To investigate the propagation of signals across the umbra it will be necessary to arrange for wireless telegraph stations on either side of the central line of the eclipse to transmit signals at intervals while the umbra passes between them. Stations other than those favoured by their proximity to the central line should endeavour to keep a complete record of the variations of signals during the eclipse.

The investigation of strays is of as great interest as that of signals. So far as is yet known, the natural electric waves reaching wireless telegraph stations in latitudes higher than 50° appear to travel mostly from the south. It is desirable that statistical observations of such waves be made all over the world, and especially at places within an earth quadrant of Southern Russia. It is also desirable that meteorological observations, including those of atmospheric ionisation and potential gradient, should be at the disposal of the Committee when considering the records of strays and signals. The Committee proposes to prepare and circulate special forms for the collection of statistics of signals and strays, especially within the hemisphere likely to be affected by the eclipse; it will endeavour to make provision for the transmission of special signals at times to be indicated on the forms; and it will offer for the consideration of the authorities controlling stations near the central line a simple programme of work.

The Committee will be greatly aided in the organisation of this investigation if those possessing the necessary facilities and willing to make observations during the eclipse will communicate with the Hon. Secretary, Dr. W. Eccles, University College, London, W.C., at the earliest possible date.

Water Power in the Highlands.—In the Parliamentary Papers, Mr. Cathcart Wason asked the Secretary for Scotland if he was aware of the continuing depopulation of the Highlands and islands owing to lack of profitable employment, and that much might be done to encourage extensive cultivation and industrial development by utilising the water power now running to waste. Mr. McKinnon Wood said the suggestion would receive consideration.

Coke from Peat.—Enterprise in Germany has hitherto rested satisfied with utilising peat for the production of portable fuel, or its conversion on the spot into heat for the generation of electricity at the bulk supply stations. Lately a new departure has been made at Elisabeth-Fehn, in the Grand Duchy of Oldenburg. Here a turf-coking plant has been erected on the moor which converts the peat directly into coke, in the ratio of 30 tons peat to 9 tons of coke, with gas and tar as by-products. The ovens are of a special design, and the gas generated is used, in the first place, to heat the retorts, and the surplus for the generation of electricity, which is employed to drive the peat-dredging machines. From the tar are obtained creosote oil, gas oil, paraffin, pitch, sulphuric acid and ammonia. Peat coke is specially adaptable as fuel for smiths' fires, as well as for various metallurgical purposes. It is especially suited to the production of high-quality iron, and may thus be employed as a substitute for charcoal.—*Zeitschrift für Elektrotechnik und Maschinenbau.*

Fatality.—According to the *Cornish Echo*, a young man named Arthur Thomas, 21, was killed at East Pool Mine on March 4th. Thomas was second electrician working under the East Pool and Agar Mines, Ltd., and was at the time of the fatality engaged in the transformer house at East Pool, connecting an overhead line to the 440-volt supply. He was found dead in a sitting position in the house.

Appointments Vacant.—Assistant telegraph engineer for the Government of the Federated Malay States, age 24-30 (£360 passage); junior assistant engineer for Bedford Corporation Electricity Department; shift engineer (£120) for Barnes U.D.C. Electricity Department; charge engineer (£115) for Swansea Electricity Department. Particulars are given in our advertisement pages.

Dynamicables' Dinner.—The anniversary dinner of the Dynamicables will be held on Wednesday, April 1st, with Mr. Robert Hammond in the chair.

Large British Locomotive Tests.—In view of the interest which attaches to the electric locomotive of the future, which shall meet the conditions of main line working in this country, we reproduce some recent tests carried out on one of the new four-cylinder 4-6-0 North-Western locomotives, which were described in a recent issue of the *Railway News*.

Two runs were made, one with a special train loaded up to 434 tons behind the tender, from Euston to Crewe, and one in ordinary service, but running independently of schedule, with a train load of 360 tons between Crewe and Carlisle. In each case a dynamometer car was included, and the mean speeds in the two trips were 59·6 and 59·4 miles per hour respectively, the distances being 158 miles and 141 miles. The weights on the three coupled axles of the locomotive are in each case between 19 and 20 tons; the total weight of engine 77¾ tons, and of engine and tender 117 tons. The tractive force of the locomotive is given as 23,000 lb., and the adhesive force (quarter adhesive weight) 33,040 lb.

On the first trip 25 indicator diagrams were taken. The draw-bar effort momentarily reached nearly 14 tons at starting, continuing at approximately 5 tons for the first mile, with another momentary peak of 9 tons. At one mile from the start the data show d.b. pull, 7 tons; D.B.-H.P., 870; I.H.P., 1,155; speed, 21 M.P.H. At 30 miles, the greatest power reading is shown :—d.b. pull, 3½ tons; D.B.-H.P., 1,150; I.H.P., 1,617; speed, 56 M.P.H. At the highest-speed reading, the figures were d.b. pull, 2 tons; D.B.-H.P., 860; I.H.P., 1,183; speed, 72 M.P.H. The great majority of the draw-bar readings were between 2 and 3 tons—the mean for the whole trip being 2·4 tons. Ten out of the 25 readings showed less than 1,000 H.P. at draw-bar, and the average was 975, while the average I.H.P. was 1,358. The average D.B.-H.P. was 71·8 per cent. of the average I.H.P.

In the second run, with the same engine and driver, the starting d.b. pull was 14 tons; another record was 10 tons after a signal check on a bank; 5⅝ tons was recorded at the top of Shap bank, and in drawing up the train at Carlisle for traffic purposes, the d.b. pull exceeded the limit of the dynamometer spring (16½ tons) momentarily. Seventeen readings were taken in the journey, the greatest power reading showing d.b. pull, 2⅝ tons; D.B.-H.P., 1,082; I.H.P., 1,669; speed, 69 M.P.H. The next three readings covering 3½ miles on a 1 in 75 up grade (to Shap) show d.b. pulls, 3⅛, 4 5/16, 5⅜ tons; D.B.-H.Ps., 1,082, 1,094, 1,187; I.H.Ps., 1,606, 1,593, 1,496; speeds 58, 42½, and 37 M.P.H. respectively. Twelve of the 17 readings show under 1,000 D.B.-H.P. and the average of all was 920; the average I.H.P. was 1,387, and the average D.B.-H.P. was 66·3 per cent. of the average I.H.P. The d.b. pull readings were mostly under 3½ tons.

The figures show what one of the finest British steam locomotives can do and what the electric locomotive will have to do in order to satisfy the requirements of its prospective users.

Electrolytic Alkali Works.—A correspondent of the *Manchester Courier* states that the works of the Electrolytic Alkali Co., Middlewich, Cheshire, which have been closed for some months, have been sold to a new company, and will be restarted. The concern has been in the Receiver's hands since May last; attempts to reconstruct the company and sell the works as a going concern failed, but on Saturday last the Receiver was authorised by the Judge to accept an offer he has received for the works complete. The old company, which was formed to manufacture soda, &c., by a patent process, had a capital of nearly £500,000.

Lamp Business in Germany.—The glow lamp cartel or trust embracing the manufacturers of Germany, Austria-Hungary, Holland, Italy and Switzerland, will come to an end on the 31st of the current month, after an existence of 10 years. The sales office of the union will, it is stated, be closed on that date. At its start the sales of the associated carbon lamp makers totalled some 27,000,000 lamps. The formation of a metal-filament lamp trust is considered improbable.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The Bradford Corporation Electricity Committee has decided to advance the remuneration of the following officers in the electricity department. Mechanical and shift engineers: Mr. G. Flett, from 60s. to 65s. per week; Mr. W. Chapman, from 60s. to 65s. per week; Mr. R. D. Spurr, from 60s. to 65s. per week; and Mr. V. Horman, from 55s. to 60s. per week; Mr. F. Walton, chief draughtsman, from 65s. to 70s. per week; Mr. C. A. Gillin, mains engineer, from 70s. to 75s. per week; Mr. Q. Arbuckle, mains engineer, from 55s. to 60s. per week; Mr. A. J. Harris, works foreman (Bolton Road), from 60s. to 62s. 6d.; and Mr. H. D. Howarth, mains assistant, from 52s. 6d. to 55s. per week; Mr. F. Martin, correspondence clerk, from 47s. 6d. to 50s. per week; and Mr. A. G. Thompson, assistant correspondence clerk, from 35s. to 27s. 6d. per week. Other advances in salaries affect Mr. J. H. Schnauber, deputy electrical engineer (from £300 to £350); Mr. J. Fairburn, works superintendent (£275 to £300); and Mr. C. W. Brown, deputy works superintendent (£225 to £237 10s.). Consequent upon the resignation of Mr. J. E. Schofield, commercial assistant of the electricity department, the following appointments have been made :—Mr. Chas. E. Allsopp, to be commercial assistant (£250); Mr. F. H. Barnett, to be superintendent, consumers' department (advanced from £2 17s. 6d. to £3 7s. 6d per week); and Mr. H. W. Walker, to be installation inspector (advanced from 35s. 6d. to 47s. 6d. per week).

The Watford U.D.C. has granted the following increases to the undermentioned members of the staff at the electricity works, the alteration to take effect from April 1st next :—MR. A. W. BARHAM, chief electrical engineer, from £250 per annum to £350, with increases of £50 on April 1st, 1915, and April 1st, 1916; MR. C. D. G. GREENHALGH, assistant electrical engineer, from £150 per annum to £175, with increases of £15 on April 1st, 1915, and April 1st, 1916; MR. J. E. WALLEY, mains engineer, from £135 per annum to £145, with a further increase of £10 on April 1st, 1915; MR. G. A. AYRE, consumers' engineer, from £105 per annum to £120, with a further increase of £10 on April 1st, 1915; MR. C. H. TRITTON, senior shift engineer, from £95 per annum to £100.

MR. A. REDFEARN, chief assistant engineer at Darlington electricity works, has resigned. A mains superintendent at £200 is to be appointed.

MR. SPINK, second engineer-in-charge at Nuneaton electricity works, has resigned his position in order to take up the post of station superintendent at Worksop.

The Halifax T.C. on March 4th decided to increase the salary of the electrical engineer from £600 to £700 a year. Alderman A. Taylor, a Labour member, resisting the proposal, said a mad race was going on at present between all the large municipal authorities in the country to see who could pay the largest salary. It simply meant that what Halifax did that night half a dozen other Town Councils would be trying to do next week.

On the occasion of his marriage to Miss M. Blease, MR. JAS. L. WILKINSON has been presented by the management, electricians and office staff of the Urban Electric Supply Co. at Glossop with a silver cake and fruit stand and Wedgewood tea set; and by the tramway staff with a salad bowl and servers.

Tramway Officials.—The Bradford Tramways Committee has authorised the following advances in salaries in the Tramways Department :—Mr. T. B. Moseley, chief clerk, from £165 to £190; Mr. J. W. Foster, engineering assistant, £245 to £270; Mr. T. Stirk, traffic superintendent, £235 to £250; and Mr. J. W. Dawson, assistant electrical engineer, £245 to £270, with a further £25 in April, 1915. Technical assistants: Mr. T. G. Richardson, shed superintendent, 64s. to 70s. per week; Mr. T. P. Sykes, engineer's assistant, 64s. to 70s.; Mr. S. Pearson, draughtsman, 49s. to 55s.; and Mr. H. Sharp, draughtsman, 38s. 6d. to 45s. Works foreman: Mr. A. Olivant, foreman linesman, 50s. to 55s.; Mr. T. Shillam, engineering foreman, 46s. to 48s. The Committee has also decided to advance the maximum wages of depôt foremen to 50s. per week, to be reached by annual increments of 2s. per week, with an immediate advance of 2s. per week.

The Colne Corporation Tramways Committee, on Friday last, considered eight applications for the post of tramways manager and reduced the number to the following three :—MR. L. C. F. BELLAMY, tramway manager, Ilkeston; MR. F. G. RICHARDSON, assistant tramway manager, Bradford; and MR. S. J. HOSKEN, tramway manager and engineer, Darwen.

MR. W. T. ROBSON, general manager of the South Shields Corporation Tramways, was unanimously voted an increase of salary of £50 per annum at the monthly meeting of the Town Council on March 4th.

The salary of MR. F. J. S. HOSKEN, tramway manager at Darwen, is to be advanced from £200 to £225.

General.—MR. W. J. LARKE, who for some 14 years has been manager of the power and mining department of the British Thomson-Houston Co., at Rugby, has, in view of the extensive developments which have taken place at the company's Rugby, Coventry and Willesden factories, been appointed to the engineering and manufacturing departments, to assist the chief engineer. Mr. Larke's headquarters will be at Rugby, and communications should be addressed to him care of the B.T.H. Co., Ltd., Rugby.

MR. PERCY GOOD informs us that he has now severed all active connection with Messrs. Neville, Williams & Co., and has joined Mr. C. le Maistre. His address in the future will be: Le Maistre and Good, 28, Victoria Street, Westminster.

MR. EDWARD C. WALLWORK, who has been appointed assistant contracts engineer of the Callender's Cable and Construction Co., London, has been employed in the Ashton electricity department for the past 14 years.

MR. H. RAWLINSON, who has left the staff at the Helsby Cable Works to take up another position, has been presented with a dressing case.

MR. E. P. BARFIELD has resigned his position of commercial manager to the Edison & Swan United Electric Light Co., Ltd.

MR. J. AUSTIN BAKER, has joined the traction department of the British Westinghouse Electric and Manufacturing Co., Ltd., Trafford Park, Manchester. He has resigned a position as assistant to the rolling stock superintendent, West Ham Corporation, in order to take up the appointment.

MR. W. E. MILLER, who has had many years' experience of Carron Co.'s cooking and heating apparatus, has been appointed works representative for their electrical cooking and heating department in Scotland and the Midlands.

The Newcastle-on-Tyne City Council, on 4th inst., adopted the motion of the Lord Mayor, referred to in our last issue, resolving to confer the honorary freedom of the city upon SIR JOSEPH W. SWAN, "in recognition of his distinguished services in the cause of science, especially in the inventing and perfecting of incandescent electric lamps, and improvements of photographic processes," and upon SIR C. A. PARSONS, "in recognition of his distinguished service in the cause of science, particularly in the invention and development of steam turbine engines."

It is announced that MR. CHARLES BRIGHT, F.R.S.E., has left for Panama, and that he will be away for some weeks.

The *Commonwealth Engineer* states that MR. ASHTON BREMNER, for some time with the Hydro-Electric P. and M. Co., is now engineer to the Harbour Board, Devonport, Tasmania.

MR. W. G. YUILLE, who has been for the past eight years with the General Electric Co. (Glasgow branch) as manager of the switchgear and arc lamp departments, was presented by the staff with a gold watch on leaving the company. Mr. Yuille has joined the firm of Mr. J. T. Cartwright, 3, Cadogan Street, and 102, Holm Street, Glasgow, as electrical manager.

Messrs. A. & P. Steven, of Glasgow, have appointed MR. W. H. FLOOD, late manager of the electrical department of the Thames Iron Works, as manager for their London branch.

MR. THOMAS R. MARTIN has resigned the position he has held for the past six years with the Metallic Seamless Tube Co., Ltd., and on the 30th inst. will join Messrs. J. H. Tucker & Co., of King's Road, Hay Mills, Birmingham, as their sales manager.

MR. W. T. BOWER, late supplies manager, Messrs. Siemens Bros. Dynamo Works, Ltd., Cardiff Branch, has been appointed general sales manager to the Metallic Seamless Tube Co., Ltd., Electrical Supplies Department, Meta House, Corporation Street, Birmingham. The trade are invited to forward their latest lists.

Obituary.—We regret to record the death, on February 9th, at the very early age of 27 years, of MR. N. C. ESPIE HALL, manager and engineer of the Penang branch of Messrs. Siemens Bros. Dynamo Works, Ltd. Deceased was widely respected by the whole of the company's staff in the Eastern branches, and the offices in Penang, Singapore, Kuala Lumpur, and Rangoon, were closed on the day after his death. The funeral took place in the evening, Messrs. Butcher and Rudd representing the firm. Military honours were accorded, Mr. Hall being a member of the Penang Volunteer Corps. Mr. Hall was transferred from the Siemens London office to Singapore in 1910, proceeding later to Penang, where he had been for two years. He was subject to attacks of dysentery for about a year, and this complaint and a cold were the cause of death.

MAJOR RICHARD BRADLEY, J.P., who died at Stalybridge on March 4th, was formerly in the service of the British and Irish Magnetic Telegraph Co. Subsequently, when the company was taken over by the Government he became a Government servant, and in 1884 he went over to the National Telephone Co., and took charge of a district from Halifax to Huddersfield and Penistone. Deceased was 77 years of age.

We regret to announce the death of MR. J. W. JACOMB-HOOD, chief resident engineer to the London and South-Western Railway. The deceased gentleman was out at the meet of the Dulverton Hounds last Friday, when apparently he was taken with heart failure, and was found dead by the side of his horse. Mr. Jacomb-Hood took a deep interest in the question of electrification of the South-Western Railway, and carried out a prolonged investigation into the subject some years ago; he also took a prominent part in promoting the adoption of electric lighting on the S.W. Railway trains.

MR. JOHN GOTT.—We deeply regret to record the death, which occurred at Hove on March 8th, of Mr. John Gott, the well-known chief engineer of the Commercial Cable Co. The deceased gentleman, who had been connected with the company from its inception in 1884, was a leading inventor and expert in the field of practical telegraphy, and we hope to refer to his work and career in our next issue. Mr. Gott was in his seventy-fourth year.

Wills.—The late MR. E. A. LAZARUS-BARLOW, a director of the Anglo-Argentine Tramways Co., Ltd., and once a chairman of the British Thomson-Houston Co., Ltd., left estate valued at £226,232 gross, and £221,315 net.

MR. J. H. R. TASKER, chairman of Tasker's Engineering Co., Ltd., of Sheffield, left £28,215 gross, and £21,309 net personalty.

NEW COMPANIES REGISTERED.

Argentine Traction Co., Ltd. (134,332).—This company was registered on March 4th, with a capital of £20,000, in £1 shares, to carry on the business of motor-omnibus, car, van and cab proprietors, carriers of passengers and goods, electricians, engineers, founders, &c. The subscribers (with one share each) are:—W. Postlethwaite, 119, Mildmay Road, Mildmay Park, N., clerk; F. H. Rover, 3, Newton Road, Stratford, E., clerk; E. F. Robson, 194, East Surrey Grove, Peckham, S.E., clerk; F. Channon, Meggen, Woodford Green, secretary. Private company. The number of directors is not to be less than three or more than five; the subscribers are to appoint the first; remuneration, 10 per cent. of the surplus profits after 10 per cent. dividend is paid, divisible. Solicitors, Francis Voules & Co., 65, Bishopsgate, E.C.

Harman Electric Co., Ltd. (134,368).—This company was registered on March 5th, with a capital of £2,000 in £1 shares, to take over the business of electrical engineers, carried on by Marryat & Harman, at 7, Fort Street, Spitalfields, E. The subscribers (with one share each) are:—H. Marryat, 28, Hatton Garden, E.C., engineer; E. J. Harman, 179, Kingston Road, Ilford, engineer. Private company. The number of directors is not to be less than two or more than five; the first are H. Marryat and E. J. Harman (both permanent); qualification, one share. Registered office, 7, Fort Street, Spitalfields, E.

Fenn Mirrograph Co., Ltd. (134,407).—This company was registered on March 6th, with a capital of £3,000 in £1 shares, to carry on the business of manufacturers of, and dealers in, electrical and other mirrors, "Mirrographs," signs, lamps, reflecting, advertising and exhibiting appliances, &c., and to adopt an agreement with B. B. Fenn. The subscribers (with one share each) are:—F. J. Purdie, 23, King Street, E.C., managing clerk; B. Middleditch, 46, Palace Road, Crouch End, N., solicitor. Private company. The number of directors is not to be less than two or more than four; the first are B. B. Fenn (works manager), S. F. Sobell (clerical manager and secretary), and J. Feinstein (sales and organising manager), each of whom may retain office for life; qualification, 200 shares; remuneration of B. B. Fenn, £7 per week; of other two permanent directors, £5 per week. Registered office, Albemarle Mansion, Albemarle Street, Piccadilly, W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

County of Dorset Electric Supply Co., Ltd.—Particulars of £13,000 debentures, created February 24th, 1914, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital (if any). No trustees.

Rugby Lamp Co., Ltd.—Issue on February 25th, 1914, of £700 debentures, part of a series of which particulars have already been filed.

Liverpool Electric Welding Co., Ltd.—Issue on February 4th, 1914, of £100 debs., part of a series of which particulars have already been filed.

City of Oxford Electric Tramways, Ltd.—Particulars of £46,000 debs., created February 20th, 1914, and secured by trust deed of even date filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: Tramways and the right of user of same, and of levying tolls, rates, fares and charges in respect thereof, and lands with buildings thereon, and all other premises vested in the company by the Oxford and District Tramway Acts (1907 and 1909), and the Oxford and District Tramways Bill, 1914, if and when passed, and all rails and appurtenances connected therewith, and the company's undertaking and property, present and future, including uncalled capital. Trustees: Union Commercial Investment Co., Ltd., Dashwood House, 9, New Broad Street, E.C.

City of Ely Electric Light and Power Co., Ltd. (85,444).—Capital, £5,000 in £1 shares. Return dated January 12th, 1914; 3,003 shares taken up; 2s. per share called up; £300 6s. paid. Mortgages and charges: Nil.

Cutting Bros., Ltd. (81,178).—Capital, £6,000 in £10 shares. Return dated December 31st, 1913; 500 shares taken up; £10 per share called up on 100; £1,000 paid; £3,200 (£8 per share) considered as paid on 400. Mortgages and charges: £3,600.

Spagnoletti, Ltd. (94,447).—Capital, £20,000 in £1 shares. Return dated December 17th, 1913. 12,352 shares taken up. £2,707 paid. £9,645 considered as paid. Mortgages and charges: £12,500.

Sheffield Electric Power Co., Ltd. (106,880).—Capital, £2,000 in £1 shares. Return dated December 31st, 1913. Two shares taken up. £2 paid. Mortgages and charges: Nil.

Davies, Kent & Stewart, Ltd. (81,627).—Capital, £3,500 in £1 shares (2,500 pref.). Return dated December 31st, 1913. 1,974 pref. and 1,000 ord. shares taken up. £2,974 considered as paid. Mortgages and charges: £1,050.

Westinghouse Cooper-Hewitt Co., Ltd. (89,947).—Capital, £30,000 in £1 shares. Return dated January 12th, 1914. 10,000 shares taken up. 9s. 6d. per share called up on 30,000 ord. £14,250 paid. Mortgages and charges: Nil.

Osram Lamp Works, Ltd. (95,312).—Capital, £100,000 in 7,500 "A" and 2,500 "B" shares of £10 each. Return dated January 14th, 1914. All shares taken up, £10 per share called up on 5,000 "A," £50,000 paid; £50,000 considered as paid on 2,500 "A" and 2,500 "B." Mortgages and charges: £30,000.

Standard Cable Manufacturing Co., Ltd. (100,967).—Capital, £50,000 in £10 shares. Return dated November 6th, 1913, 2,494 shares taken up, £24,940 paid. Mortgages and charges: Nil.

CITY NOTES.

County of London Electric Supply Co., Ltd.

THE Directors' report for the year ended 31st December, 1913, states that the capital expended on account of the London districts amounted to £67,050, making the net total expenditure on those districts £1,952,698. The balance from revenue after deducting generation and distribution costs, rents, rates, taxes, wages, directors' fees, general establishment and other charges, and proportion of salaries, has been £147,812 for the year plus £5,215 brought forward, making £153,028. There are deducted the following: interest on first and second debenture stock and interest on temporary loans, £43,049; reserve for depreciation, repairs, renewals, etc., £33,000; leaving for distribution £76,979. Interim dividends on 55,000 six per cent. preference shares, and on 59,000 ordinary shares, for the half-year ended 30th June, 1913, at the rate of five per cent. per annum, less income tax, have been paid and now require confirmation. These interim dividends absorbed £29,427, and leave for further distribution the sum of £47,552. Payments of 6 per cent. on the preference shares, and two dividends of 5 per cent. and 9 per cent. for the two half-years respec-

tively on the ordinary shares, making 7 per cent. for the year, absorb £40,539, and leave £7,013 to be carried forward. The applications received during the past year amounted to the equivalent of 4,137 K.W., making the total at 31st December last 49,499 K.W. The total units sold were 25,743,323, an increase for the year of 3,230,845 units. The number of consumers has increased from 20,246 to 22,315. The Romford and District Electric Lighting Order, 1913, granted to this company, received the Royal Assent in August last. In order to provide funds for the further development of the company's business, the directors propose to make a further issue of 10,000 6 per cent. cumulative preference shares at £11 per share, and 6,000 ordinary shares at £11 10s. per share. These will be allotted to the existing preference and ordinary shareholders on the register of the company on March 6th in the proportions as nearly as may be of one new preference share for each twelve preference or ordinary shares already held, and one new ordinary share for each twenty preference or ordinary shares already held. It is proposed to send out the allotment letters with the dividend warrants. The shareholders were informed at the recent extraordinary general meetings that certain proposals had been made by influential financial houses to the London Electric Supply Companies with a view to association and the adoption of a general scheme for supply, with the object of assisting the development of electric supply in London. The chairman will outline these proposals at the meeting. The Bill promoted with a view to assisting the London Electric Supply Companies fully to exercise the powers conferred upon them by the London Electric Supply Acts, 1908 and 1910, by enabling the companies and the L.C.C. to enter into agreements for variation of date and terms of purchase of the companies' undertakings, was on the 9th February last approved by a special resolution of the company. The Bill has been introduced in the interests not only of this company, but also in those of all the other London Electric Supply Companies. This company will not have to bear any expense incurred in connection with the promotion of the Bill. The directors of the Bournemouth and Poole Electricity Supply Co., Ltd., have declared a final dividend on the ordinary shares of that company at the rate of 9 per cent. per annum, making 7 per cent. for the year. The progress made by the Coatbridge and Airdrie Co. during the past year has been satisfactory.

Units generated and purchased	34,224,914
Units sold—Public lamps	391,920
Private consumers, by meter	24,451,403
Total sold	25,743,323
Used on works	2,745,387
Total accounted for	28,488,710
Not accounted for	5,736,204
Public lamps	363
Total maximum supply demanded	14,400K.W.

The meeting is called for March 16th.

W. T. Henley's Telegraph Works Co., Ltd.

Mr. Sydney Gedge presided on Friday at the offices, 13, Blomfield Street, over the thirty-fifth ordinary general meeting of the above company.

In moving the adoption of the report (see Elec. Rev. p. 403) the chairman said it was just ten years ago when they met for the first time in that room. The year 1903 was not only remarkable to them in that they bought this property, but because they had then nearly completed the purchase of eleven acres at Gravesend, on which they had since erected works, in regard to which, with some experience, he had little hesitation in saying, there were no better anywhere in the United Kingdom. They had plenty of room and magnificent works. Ten years ago he ventured to prophesy that they would have to call up more capital, but he promised that this should not be done until such capital would be profitable. At that time they had £175,000 ordinary capital, £150.000 preference stock, and £50,000 debenture stock. Now they had £200,000 ordinary and £200,000 preference capital, and £150.000 debenture stock, and this, except the ordinary stock, had been raised at a rate of 4½ per cent. Ten years ago the profits came to £38,700, and they had a dividend of 20 per cent. It may have been imprudent to have paid such a large dividend, but the shareholders had waited patiently, and they divided the money. He was glad to say more prudent counsels had prevailed since, and they had paid a steady dividend of 15 per cent., with one bonus of 2 per cent. They were going to continue the 15 per cent. this year, but for special reasons they also proposed to pay a bonus of 5 per cent. Seeing that their total profit for the year was £93,500, no one would say they were imprudent in doing this. It looked a big dividend, but as he had pointed out, a great deal of their capital received only 4½ per cent., and they had £200,000 reserve fund, a great deal of which was employed in the business. Ten years ago the reserve fund was £100,000, and since then they had been increasing their business, purchasing property, making ample provision for dilapidations, and so on. Seeing their strong financial position, he was amazed that their shares did not stand a great deal higher than they did. Ten years ago Mr. Sutton said that the eleven acres at Gravesend was more land than they wanted at the time, but he said that the company was not for to-day or to-morrow. This was the thirty-fifth year of the company's existence, and, he thought, it bade fair to go on. The chairman proceeded to quote from articles written in the daily papers with regard to the progress of the company, and said that the company could be termed both conservative and progressive. They were progressing all over the world. In Australia, Argentina, China, Japan—in fact there was hardly any part of the world where they had not their agencies and were doing good and lucrative business. With regard to that year's accounts, it would be noticed that they had made ample provision for depreciation of the investments, although he was glad to say that since the 31st December some of their gilt-edged securities had risen very considerably. They had applied £16,000 to the depreciation of machinery and plant, which was £2,000 more than last year, and this was owing to their having dismantled certain plant so as to install fire sprinklers, which would not only be a protection in case of a fire, but would also result in a decrease in their insurance premiums. They had spent £35,000 on works at Gravesend, where they were introducing a motor tyre department. Altogether he might say that they were going on well, and there had been few accidents and very little ill-health amongst their employees. The chairman then referred to the ill-health of Mr. Newton, which had caused his retirement from the board, and said that they had elected Mr. Potter in his place. He also said that owing to the increase in their business they had appointed Mr. Rosling, who for some years was their agent in Australia, as assistant manager to Mr. Sutton. As they knew, Mr. Sutton had himself personally opened up many of their agencies, and it might be said that he would be going to South America on the business of the company, and it was well they should have someone to represent him when he was away.

Mr. Sutton, in seconding the motion, said that comment had been made on the fact that whilst the report gave a clear statement of the financial position of the company, yet there was only a very bald statement of how the financial position had been achieved. No doubt that was the case, but a full statement of trade was always given at the meeting. The year under review had been the very best year the company had ever had. It was the best in all respects. It was the largest in the number of orders actually received, the largest in the actual amount of material which had been used at the works, and the largest in the actual amount of sales made. This was due to an increase in all departments of the works with one exception, namely, the submarine cable business, which in the first days of the company was practically the only business it did. It was natural that in a business of this kind the home trade should be the best asset the company had, and the board was quite satisfied with the growth of their home trade. A very large increase had taken place in their trade during 1913, and although the percentage of profit had not been so great as in the previous year, still they looked on it as a most healthy sign that by a reduction of profit they were able to do more business. The most remarkable feature of the year had been the foreign trade, which had grown by leaps and bounds. In telephony the company were getting a fair share of the cable work in connection with the extensions in this country. They had a mill manufacturing for the post-office the cables for laying down between Leeds and Hull, Coventry and Birmingham, Newport and Cardiff, Cardiff and Swansea, London and Slough, and so on. The foreign trade in connection with telephony was not a large one, but the Colonial trade was considerable. One important contract was for a submarine telephone cable, which was called a continuously wound cable, and was laid to connect Vancouver Island with the main land. It was 30 knots long, and they had received intimation that it was doing its work well. A similar cable was now being made for the Danish Government. They had to wind fine iron wires round the conductor, and they had to make 1,500 millions of turns of the iron wire round the conductor. It was difficult to realise what 1,500 millions meant, but they had had to construct machines to do the work within reasonable time. They had had many important contracts in connection with electric lighting, and perhaps the foreign contract which gave them the most satisfaction was a considerable order for Shanghai, because hitherto the cables for that place were supplied from other countries, and now, after many efforts, they had got an order. In connection with electric lighting the company had devised a new system—Henley's wiring system. It was a surface wiring system and had met with considerable success. Many orders had been taken, especially for abroad. It was useful for cottage property, for it made it possible to put electric light into workmen's cottages whilst at the same time it was used in the palace. It was used in the cathedrals of Lahore and Bermuda. He thought it had a good future before it. Having referred to the work done by the company for the Navy and for the mercantile marine, Mr. Sutton said that probably one of the most important fields of their work was to be found in the electrification of railways. Last year he told them that the most important order which had ever been placed for cables for the electrification of railways had been placed with them by the Central Argentine Railway. The whole of the cables had been manufactured and delivered in Argentine, and were now being laid. The order was not, however, finished, and would probably occupy them another year. In addition they had been entrusted with a small order by the London and North Western Railway for certain cables for the Willesden electrification, and quite recently they had had an order placed with them for the

cables for the electrification of the suburban lines of the Buenos Aires Western Railway Co. They had not yet commenced to manufacture it, but the contract involved something well over £200,000. The shareholders could well understand the one reason why such great orders were placed with the company, involving such great responsibilities, was the strong financial position of the company as shown by its published balance sheet. Mr. Sutton next touched on business which had attended the manufacture of the "Why not" golf ball, which had enabled them to pay the 5 per cent. bonus that year, and he said that they were eleven years experimenting to get a ball which would bring them in a large sale. They commenced the manufacture of tires in August, but they were in no hurry to make a profit. They had as perfect a factory as could be constructed, and the management was in the hands of two men who had had a large and wide experience in the motor trade. They were trying to produce a tire which would be second to none and better than most. The sales they had been able to effect were such that they were already considering the trebling of the size of the factory. They had capital sufficient to enable them to carry out that extension now, and although, of course, if it became a large industry they might have to seek fresh capital, yet they had no intention to ask for further capital until they could show it would be profitable.

Mr. Jenkins congratulated the board on the success which had attended their efforts.

Mr. Crighton raised the question of the company embarking on some profit-sharing system.

Mr. Sutton pointed out that there were very great difficulties in formulating a satisfactory profit-sharing scheme for such a company as this. At the same time the board always had the welfare of the employees in their minds, and they had in many ways given effect to this.

The report was then adopted.

County of Durham Electrical Power Distribution Co., Ltd.

The directors report that the total connections to the system at the end of 1913 (including the connections of the Associated Parliamentary Co., the County of Durham Electric Power Supply Co.) amounted to 70,495 h.p., an increase of 15,970 h.p. The profit for the year is £30,252 (as compared with £33,737). Including the balance brought forward, £1,863, the total is £32,115, against which has been charged interest on loans and Debenture stock, £12,504, leaving £19,611 (as compared with £20,364). A dividend of 5 per cent. for the year on the Preference shares absorbs £12,500; there is transferred to depreciation account £6,000, and £1,111 is to be carried forward. The expenditure on capital works during the year has been £14,985, of which £3,171 represents the outlay on the company's account, and £11,814 the outlay on behalf of its associated company, the County of Durham Electric Power Supply Co. The difference between the above figure of £3,171 and the credit of £6,423 shown in the capital account is accounted for by the fact that a sum of £9,594 has been written off manufacturers' installations accounts. The profit of the year has been adversely affected by the high cost of coal, and by a reduction in the dividend received from the County of Durham Electric Power Supply Co. owing to increased rentals and interest charges paid by that company. During the year the directors have appropriated the balance of £12,845 standing to the credit of depreciation and reserve account at December 31st, 1912, as follows: In writing off £678, being the balance standing in works in progress account, after transferring from that account £552 to lands accounts; in writing £9,594 off manufacturers' installations accounts; in writing £2,573 off expenses of issue of capital account. The boards of this company and the Newcastle-upon-Tyne Electric Supply Co., Ltd., have for some time had in view the advantage of a closer union of interests between the two companies, and after due consideration they have come to the conclusion that this will best be attained by the Newcastle Co. acquiring, by exchange, the shares in this company. The Board of the Newcastle Co. is recommending that the Newcastle Co. should acquire the outstanding shares in this company upon the following terms:—

The Newcastle Co. to give each Preference shareholder in this company £4 10s., fully paid, of the 5 per cent. Preference share capital of the Newcastle Co. in exchange for every £5 of Preference share capital held by him in this company, and to give each Ordinary shareholder in this company £1 10s., fully paid, of the Ordinary share capital of the Newcastle Co. in exchange for every £5 of Ordinary share capital held by him in this company. Fractions of £1 to be dealt with by issuing fractional scrip in the usual way.

The effect of the exchange to the Durham shareholders on the basis of the middle market prices as quoted on the Newcastle Stock Exchange on February 18th, 1914, is shown by the following:—

£4 10s. of the Newcastle Co.'s £5 Pref. shares was equivalent to	£3	19	10
Market price of the Durham Co.'s £5 Pref. shares	2	17	6
£1 10s. of the Newcastle Co.'s £5 Ord. shares was equivalent to	1	3	6
Market price of the Durham Co.'s £5 Ord. shares	0	18	6

The directors are satisfied that the proposed exchange would be advantageous, and accordingly recommend acceptance by the shareholders of the Newcastle Co.'s offer.

The annual meeting was held in Newcastle-on-Tyne on 6th inst., Dr. J. T. Merz, the chairman, presiding.

The Chairman, in moving the adoption of the report, said that although the profits of the company were smaller than last year, the progress in actual working of the company had been considerable. They had increased their h.p. connections by 15,970 against an increase of 11,000 the year before. The capital expenditure had been only small, £14,985 against £47,648, and the profit was rather less, being £30,252 against £33,737 in 1912. The total gross profit was really considerably more than appeared in that report. As a matter of fact, the actual amount of return on capital had increased from £68,000 to £75,000, or by more than £7,000, but inasmuch as the lion's share went to the Supply Co. in the form of a K.W. charge, which was a capital charge, it did not appear in their accounts, and therefore the profits that went to the shareholders were less than last year. If they took the actual earnings of the capital, they had a return of 5.7 per cent, but inasmuch as they had to pay such a large charge on a portion of their capital, what remained was not more than enough to pay the preference dividend, and leave over a small amount for depreciation. In regard to the fusion scheme, the reasons for fusion so far as the Durham Co. was concerned were very simple. The company could not carry on excepting by an increase of expenditure on capital account. The payment by the company for the supply of current was continually increasing. The only way the company had of obtaining money was to borrow from the Supply Co., or rather to defer the payments which they had to make to the Supply Co. as K.W. charge. In consequence of that the directors had thought it right and timely to put the business on to a right and proper footing, and inasmuch as the Supply Co. were very largely interested in the company—they were the Supply Co's. largest consumer—it was thought right that the Newcastle Co. should in some way or other absorb the whole of the business. The Newcastle Supply Co. had at their meeting an hour earlier, agreed to make an offer to the shareholders of the Durham Co. This offer involved a depreciation of the company's capital from £500,000 to £300,000. This depreciation had arisen from the payment of £50,000 for the agreement with the Supply Co., which, when it was made, nine years ago, was a good agreement; in £27,000 in preliminary expenses; and on stations that had become obsolete, amounting in all to £197,190. This reduction in the capital would have had to take place in any case.

Mr. Madgen seconded the report. He said he had no interest in the Supply Co., and he thought that the fusion was desirable and the terms reasonable. The Supply Co. was the manufacturer of electrical energy on a large scale in that district, and the Durham Co. retailed it amongst its various consumers in the same district. That seemed a straightforward arrangement, but it had been found in practice that with large consumers anomalies occurred, and that it was difficult to make equitable adjustment. For that practical reason, and others, he thought the closer unity of interests was desirabie. Fully 50 per cent. of the outside shareholders in the Durham Co. had expressed their approval of the scheme.

Mr. J. H. Armstrong said there was an idea amongst shareholders—and it was quite true—that they need not join in that fusion. It was perfectly open for every shareholder to either exchange his share or to stay in that company. Some shareholders had an idea that, sooner or later, the Durham Co. would have to be wound up, and the Supply Co. would have to acquire its outstanding shares. That was not at all the case, for the Durham Co., on account of its Parliamentary powers, must continue even if the whole of its shares were acquired by the Newcastle Co. But with the capital written down, this fact would have a prejudicial effect on the market value of the Durham shares, and as the chairman had further pointed out, the tendency of the relationship of the two companies would be to put money into the Newcastle Co. rather than into the Durham business. It was not the wish of the directors to force any of the shareholders into this combine, but it would certainly be to their interests to be in.

The report was adopted without comment.

Jarrow and District Electric Traction Co., Ltd.—Dividend on ordinary shares for 1913 at the rate of 2½ per cent. per annum.

International Light and Power Co., Ltd.—A dividend of 1¼ per cent. upon the preference shares, for the quarter ending March 31st, is announced.

Manila Electric Railroad and Lighting Corporation.—A quarterly dividend of 1¼ per cent. for the quarter to March 21st on the common stock is announced.

Canada.—The Western General Electric Co., Ltd., has increased its capital from $100,000 to $500,000. — *Canadian Electrical News.*

Capital Reduction.—In the Chancery Court on 9th inst. the reduction of capital of the British and Colonial Zoelly Turbine Syndicate, Ltd., was confirmed.

Brompton and Kensington Electricity Supply Co., Ltd.

The directors' report for the year ended December 31st, 1913, states that the revenue account shows a credit balance of £31,500, which, with the balance of £7,026 brought forward, and £425 balance of interest received and accrued, makes a total of £38,951. After deducting £1,484 for interim dividend on the 7 per cent. cumulative preference shares, and £7,091 interim dividend at the rate of 9 per cent. per annum for the half-year to June 50th on the ordinary shares, and £300 loss on the redemption and sale of investments, the directors recommend that £30,075 be dealt with as follows:—Written off cost of investments £1,333, written off shares in and advances to the Brompton and Kensington Accessories Co., Ltd., £8,000, reserve fund account (raising it to £39,500) £6,500, dividend on the preference shares for December half-year £1,449, dividend on the ordinary shares for December half-year at the rate of 11 per cent. per annum, making 10 per cent. for the year, £8,718; income-tax on dividends £922, directors' additional remuneration £1,000, carrying forward £7,153.

The following table shows the progress of the business:—

Year.	8-c.p. lamps connected.	Increase in 8-c.p. lamps.	Customers connected.	Gross receipts.	Expenditure.	Net receipts.	Av. price per unit.	Div. on ord. shares.
1911..	259,554	12,580	5,453	£54,730	£24,038	£30,692	4·29d.	10%
1912..	272,701	13,147	5,798	£56,348	£23,170	£33,178	4·18d.	10%
1913..	291,108	18,407	6,118	£56,484	£24,984	£31,500	4·08d.	10%

The meeting was held yesterday.

British Engine, Boiler and Electrical Insurance Co., Ltd.

At the annual meeting of the above company held in Manchester on Tuesday the chairman (Mr. Longridge), in moving the adoption of the report and balance-sheet, remarked that as regards premium income there had been a satisfactory increase in each separate department of their business, but there had also been an increase in claims. In calculating the loss ratio for their class of business, the cost of inspection must be added to actual disbursements for claims, and the figures showed that the insurance of electrical plant was more costly than even the insurance of engines, which again was very much more costly than insurance of boilers. The maintenance of an efficient staff for the work of inspection was of course an expensive matter, but any reduction under this head would inevitably result in an increase of claims, and that inspection was appreciated as a preventive measure was shown by the very satisfactory way in which firms continued to renew their policies, even though for a sequence of years there had been no claims to be paid on them. The great increase in the volume of work had necessitated removal to new and more commodious premises at the corner of Fennel Street and Long Millgate, which it was hoped would be occupied within the next six months. It was agreed to pay a dividend of 5s. and a bonus of 3s. per share, which, after transferring £10,000 to reserves, would leave £2,818 to be carried forward.

Stock Exchange Notices.—The Committee has appointed special settling days as under:—

Thursday, March 19th.—Anglo-Argentine Tramway Co., Ltd.—Scrip fully and partly (£20 per cent.) paid, for further issue of £1,500,000 5 per cent. debenture stock.

And ordered the following to be quoted in the Official List:—

Anglo-Argentine Tramway Co., Ltd.—Scrip, £20 per cent. paid, for further issue of £1,500,000 5 per cent. debenture stock.

British Columbia Electric Railway Co., Ltd.—Further issue of £240,000 deferred ordinary stock, £240,000 pref. ordinary stock, and £240,000 5 per cent. cumulative perp. preference stock.

Cuban Telephone Co.—$1,000,000 pref. stock, in shares of $100, in lieu of scrip.

Application has been made to the Committee for a special settling day and quotation in:—

Christchurch (City of).—Scrip, fully paid, for £100,000 4½ per cent. Electrical Power Distribution Loan.

And for an official quotation in:—

Vancouver Power Co., Ltd.—Further issue of £650,000 4½ per cent. perp. guarantee debenture stock.

Direct Spanish Telegraph Co., Ltd.—The accounts for the year ended December, 1913, show, after providing for interest on and redemption of debentures, and for the dividend on the preference shares, a balance of £11,679. Out of this the directors recommend a final dividend on the ordinary shares of 2s. per share, which, with the interim dividend, will make a total of 4 per cent. for the year, and will absorb £2,586. After crediting the reserve fund with £9,000, a balance of £93 remains to be carried forward. £8,168, being the balance of the cost of the partial renewal of the Bilbao cable in 1911, has been paid out of the reserve fund. The Bilbao cable became interrupted on October 3rd last, 240 knots from the landing place in Cornwall. The necessary repairs were effected by the cable steamer *John Pender*, and the cable was re-opened for traffic on October 14th, after an interruption of 12 days. The cost of these repairs, viz., £2,507, has been charged to revenue.

Consolidated Gas, Electric Light and Power Co., of Baltimore.—Dividends of 1½ per cent., or at the rate of 6 per cent. per annum, on the common stock for the quarter to March 31st, and 3 per cent., or at the rate of 6 per cent. per annum, on the preferred stock for the half-year to March 31st, are announced.

Continental.—France.—La Société des Acieries Electriques de Paris et de la Seine is the name of a new company which has just been formed in Paris (23, Rue de Rome), with a capital of £50,000, to establish works near Paris for the electrical production of steel.

Holland.—The Philips' Glühlampenfabrieken Maatschappij, of Eindhoven, which was formed at the beginning of 1912, with a capital of £480,000, to acquire and carry on the incandescent lamp works of Messrs. Philips, is meeting with considerable success. For the past year a net profit of £143,204 is reported, as compared with £109,760 in the first year of the company. A dividend of 11 per cent. is being paid on the ordinary, and one of 7 per cent. on the preference shares.

Norway.—It is reported from Porsgrund that a new company has recently been formed and registered, under the name of the "Porsgrund Elektrometallurgiske Aktieselskap," for the purpose of erecting manufactories for electrometallurgical processes. The company has a capital of nearly £84,000, and the sites for the factories have already been acquired. The company will have at disposal some 10,000 electrical horse-power, which will be supplied by the Skiensfjord Power Co. from the Aarlifas, which is now being harnessed. The capital is chiefly Swiss, and one of the directors is a Swiss engineer, Mr. Ullman, while the other two are Advocate Knagenhjelm and Engineer A. Christiansen, both of Christiania.

Spain.—A company has just been formed at Sabadell with a capital of £22,000 and the title La Sociedad Energia Electrica Balear, to establish electric lighting undertakings in the Balearic Islands.

Wemyss and District Tramways, Ltd.—Mr. G. Balfour, presiding at the annual meeting, referred to the prosperous year enjoyed by the company. With the view of expediting the increasing traffic, certain stretches of the track between Kirkcaldy and Leven were being doubled. The first section, covering about half of the track, to be doubled, meantime, would be completed in the course of three to four weeks, and the other half would be pushed forward without delay. Mr. Balfour called attention to what he described as the iniquitous system which prevailed of rating undertakings of the nature of the Wemyss and District Tramways. The system was one requiring the prompt attention of shareholders. Assuming a company's revenues for successive years were the same, but that through skill economies were effected to the extent of £1,000, the valuation under the existing system of rating would be increased by that amount. He thought that the system simply meant a double super-income-tax.

Carmarthen Electric Supply Co., Ltd.—Mr. W. A. Shultz presided at the annual meeting held at 50, Cannon Street, E.C., on February 25th, and in moving the adoption of the report, said that they had been able to put one-third of the profit this year to reserve, after paying a 5 per cent. dividend. The revenue had increased from £1,868 to £2,449, an increase of 20 per cent., while the expenses had increased only 18 per cent. in spite of the heavy price of fuel oil. The number of consumers had increased by 50 per cent., and the units sold had advanced by 23,424 to 103,910. In addition to the 100-kw. Diesel plant installed in 1912, they had ordered a 100-kw. vertical suction gas engine from Browett, Lindley & Co. This was now being erected. It would entail a further issue of capital.

Cambridge Electric Supply Co., Ltd.—Mr. D. Munsey presided at the annual meeting held on February 25th at Cambridge. He said that the progress made was very satisfactory. They had connected more consumers than in any previous year. The increase of £560 in cost of coal was due to an increase of 2s. 4d. per ton, and an increase of 195 tons consumed. They generated 19,000 more units. The company was in a sounder position than ever before. Sir C. A. Parsons seconded the adoption of the report. He said that they had got over the introduction of the metal-filament lamp. The price of coal would probably fall in the near future. The dividend declaration (6 per cent. for the year) was moved by Mr. A. A. C. Swinton.

International Railophones, Ltd.—According to reports in the financial Press, this company held its annual meeting at Gresham House, E.C., on 3rd inst., Mr. C. H. Potter presiding. The chairman referred to negotiations that were proceeding for the sale of the patents in Germany and America, and to the experiments with the system in Germany, and on the Midland Railway.

Midland Electric Corporation for Power Distribution, Ltd.—The accounts for the year ended December 31st last (according to the *Financial Times*) show that the balance to credit of profit and loss account, after payment of debenture interest, is £16,919 (as against £12,843 in the previous year), which the board recommend be applied as follows:—Final payment of debenture guarantee premium, £625; written off expenses of issue of debentures, &c., £4,277; for depreciation of plant, &c., £8,044; leaving to be carried forward £3,573.

Consolidated Diesel Co.—The meeting arranged for 10th inst. could not be held owing to unavoidable delays in making the valuation of the property of Messrs. Usines Carels Frères Soc. Anon.

Mirrlees Watson Co.—The *Financial News* says that the directors recommend a dividend of 5 per cent. for 1913, as compared with 10 per cent. and a bonus of 5 per cent. for 1912.

(*Continued on page* 453.)

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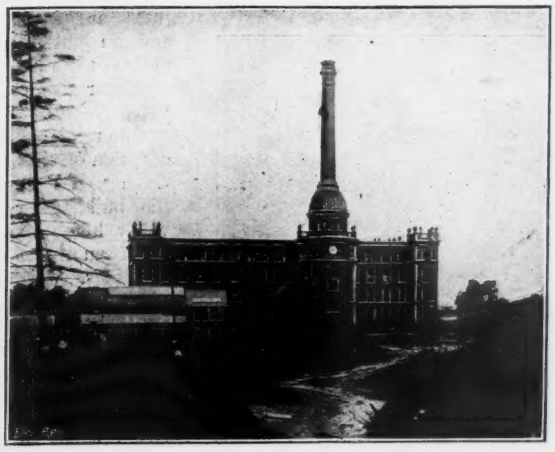
AN ELECTRICALLY-DRIVEN WEST COUNTRY WOOLLEN MILL.

The electrical driving of textile mills can no longer claim to be a novelty, even in this country—the home of the textile industry—where accepted methods, due to long years of successful manufacturing, were not easy to displace. Numerous instances of cotton, woollen, silk, jute and linen factories which have adopted the electric drive, either wholly or in part, can now be quoted, and this applies to both new and old mills, the latter of which frequently offer great scope for the increased all-round efficiency which electric driving makes possible.



Messrs. Bliss & Sons' Mill, Chipping Norton.

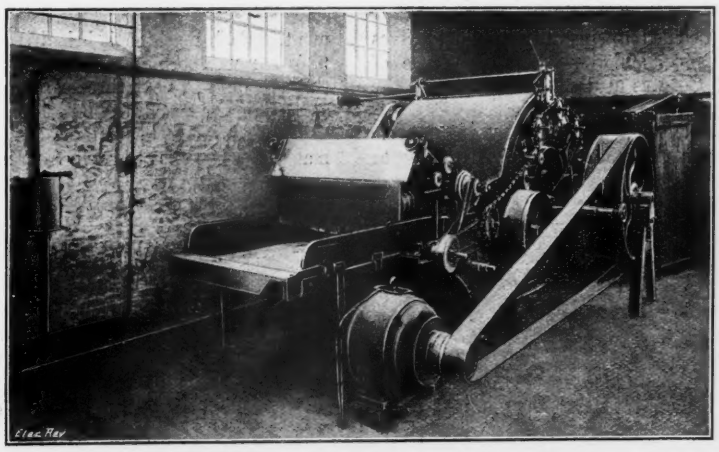
Amongst the older firms, a typical and most useful example of modern electrification is found in the woollen mills of Messrs. Wm. Bliss & Son, Ltd., at Chipping Norton, in Oxfordshire, a firm which has been in successful existence for 170 years. The business evidently antedates power driving, and contrary to the custom in the textile districts of Yorkshire, where woollen manufacturing has become split up into a number of separate trades, it embraces every process of woollen manufacturing, from the raw material (wool) to the finished cloth, in one factory—a feature which is of particular interest in view of the diversity of the machinery, all of which is now electrically driven, and the admittedly satisfactory results which have been attained.

Originally this mill was driven by two 130-h.p. slow-running beam engines, which it is recorded each used some 26 tons of coal per week; with a view to improving on this performance, and at the same time overcoming a difficulty which arose from shortage of condensing water, two Crossley double-ended gas engines were installed, with a producer plant which utilises the same class of bituminous slack which had previously been used under the boilers.

The introduction of gas engine plant reduced the coal consumption from 7 lb. per h.p.-hour to 1·8 lb., and enabled the machinery to be speeded up 10 per cent., owing to the improved speed regulation of the modern prime movers.

The gas engine drive was through ropes on to the old shafting, with numerous instances of bevel gearing on the various floors, and it is therefore not surprising that during a test some 28 per cent. of the power of one engine was found to be absorbed in transmission only.

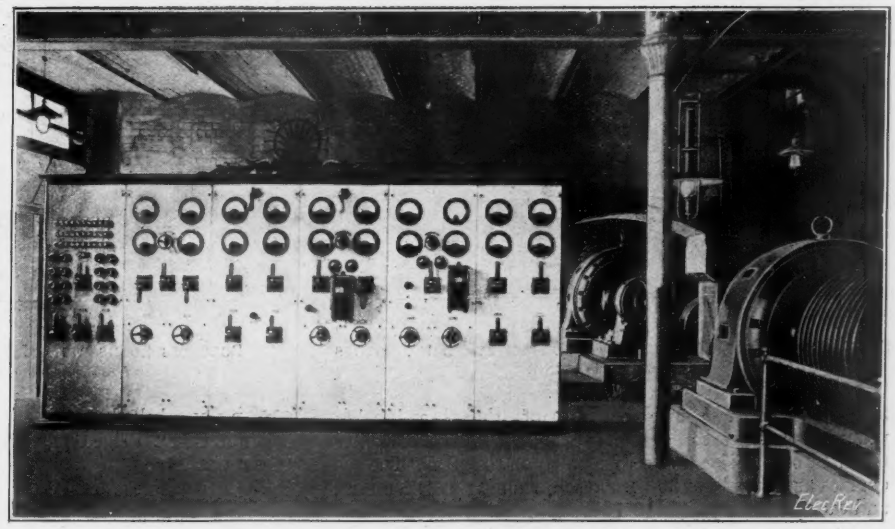
With a view to cutting down losses of this kind, the firm were led to consider the question of electric driving, and a 120-k.v.a. three-phase generator and a number of motors were installed in 1910, this equipment being provided by the Schorch Electrical Co., who, as many of our readers are aware, specialise in electro-textile installations, and were pioneers in the "single" or "individual" drive system.



Electrically-Driven Willey, with 7-b.h.p. Motor.

This installation proved so successful and led to such a saving in power, that Messrs. Bliss—who were adding further weaving, spinning and carding plant, and had actually obtained tenders for a further gas engine consequent on those already in use being overloaded—decided to proceed with the electric drive.

The Schorch Electrical Co. were then entrusted with the installation of a 250-k.v.a. three-phase generator to take the full power

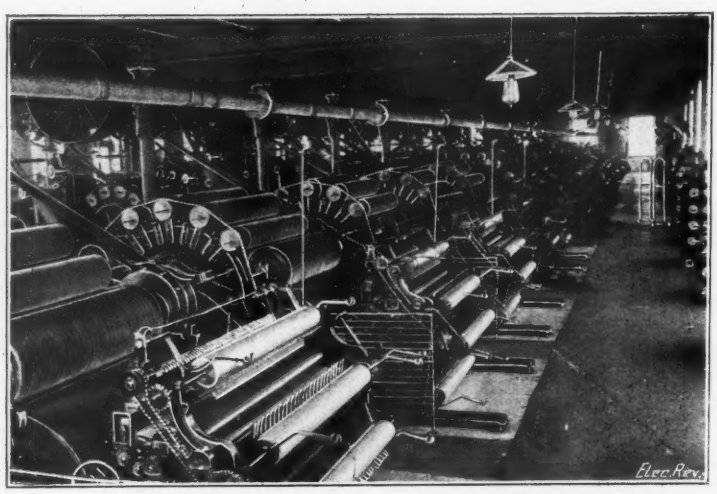


Main Switchboard and Rope-Driven Generators.

of one of the gas engines, and gradually other sections of the plant were converted to electric driving, the resulting saving in power being such that at times one engine drove the whole mill. Early last year the generating plant was duplicated, another 250 K.V.A. generator being coupled to the other engine and the remainder of the plant was converted to motor driving.

The result has been in every way satisfactory; the two gas engines which were originally overloaded do not now develop their full output by about 100 H.P., and this despite various machinery additions in the meantime.

In this as in other mill electrification schemes the question of individual or group driving arose, and with a view to deciding the question records were made of the average time during which machines were standing and running, it being found that these were 40 per cent. and 60 per cent. respectively.



Carding Machinery, Group Driven from Ceiling Motors.

It was eventually decided to install individual drives wherever practically possible, and the expert experience of the Schorch Electrical Co. was utilised in rearranging the various drives.

Turning to the installation, two 250-K.V.A. 50-cycle 220-volt three-phase generators are in use, running at 375 R.P.M.; these machines are of the three-bearing pedestal type, with a direct-coupled 110-volt exciter mounted on one side and a rope pulley on the other. The gas engines are roughly of 300 H.P. each, running at 185 R.P.M., and each drives through 10 $1\frac{3}{4}$-in. ropes.

A marble panel switchboard is provided, coupled to the generators and to distributing points in the mill by three-core, lead-covered and steel-armoured cables; this contains six panels, which control the mill lighting circuits, the two main generators and eight feeders.

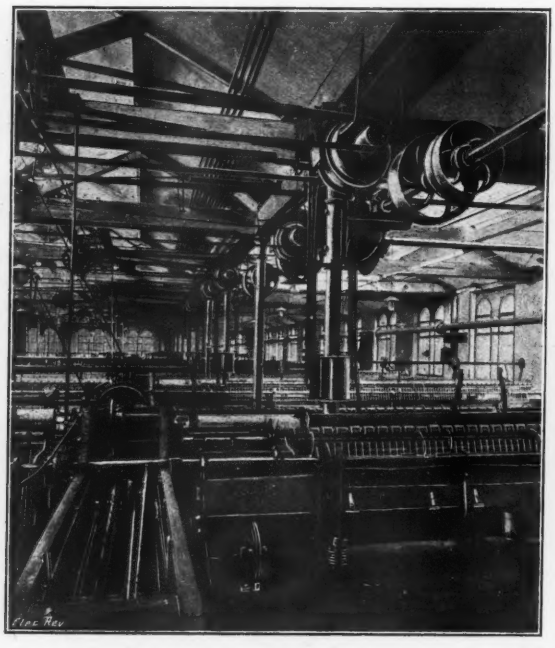
The generator panels are each fitted with an Aron meter, exciter and generator ammeters, a voltmeter and a watt-hour meter, and an ammeter is provided for each feeder.

The switchboard is of the Schorch Co.'s standard pattern, with no current-carrying fitting in front and flush type instruments; the fuses are behind, and an automatic magnetic voltage regulator is provided.

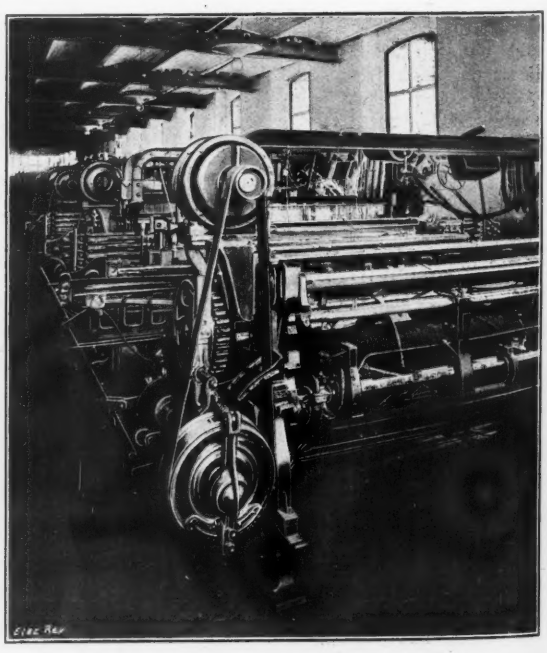
One result of the adoption of electric driving has been the building of a willey house separate from the main buildings, with a view to isolating this dirty process from the others. In this building are installed a tenter-hook willey and a shake willey, both by Messrs. Morton, Son and Co., for breaking up the incoming wool and preparing it for the carding department. Each machine is belt driven from a 7-B.H.P. motor, 980 R.P.M., both motors and lighting being supplied through a 220-volt three-core armoured cable leading to a distributing box in the building.

In the scouring department the wool washing and drying machinery is partly driven from a 15-B.H.P. motor, speed 575 R.P.M., belted to shafting, but a Whiteley drying machine is belt driven from a 7-B.H.P. motor, running at 980 R.P.M.

Both machines are of the squirrel-cage type, bolted to sliding bedplates on the ceiling, and thus occupying no valuable space. It should be mentioned that all the motors, except one of 50 B.H.P., are of the Schorch squirrel-cage



Self-acting Mules, Individually Driven by 5-B.H.P. Motors Fixed to Ceiling.



Dobcross Looms, with Individual Motor Drives.8

totally-enclosed type, and are provided with the company's oil-immersed, star-delta starting switches, fitted with a mechanical slow-motion starting device.

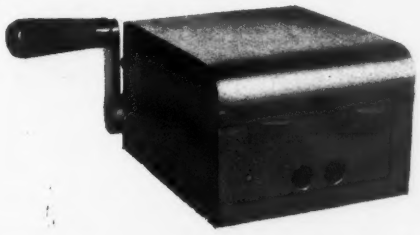
The 50-B.H.P. motor is of the open slip-ring type, speed 580 R.P.M., with a Westinghouse chain drive on to a line shaft which operates certain machinery in the finishing and milling departments. In the dyehouse a 7-B.H.P., 960 R.P.M. motor drives various plant through shafting, and a 3-B.H.P. back-geared 1,500 R.P.M. motor operates a two-piece dyeing machine and a wool-dyeing machine.

The first floor of the main mill contains twisting machinery by Messrs. Prince, Smith and Messrs. Sykes, each machine being individually driven by totally-enclosed 6 and 7-B.H.P. motors, running at 980 R.P.M., through fast and loose pulleys.

On the second floor are 17 sets of carding machinery, each consisting of a scribbler, intermediate and condenser. These are divided into groups for motor driving purposes, *i.e.*, three groups of four machines, and one of five, as the power required for starting up is considerable, but subsequently falls off, and the machines are run continuously from morning to night.

The motors are of 20 B.H.P., 575 R.P.M., with a driving pulley at both ends of the shaft, and are fixed to the ceiling.

On the third floor of the main mill weaving, carding and spinning machinery is installed. Here a number of 90-in. reed space 100-pick Dobcross looms, by Messrs. Hutchinson, Hollingsworth & Co., are individually driven, the 1 B.H.P., 950 R.P.M. Schorch loom motors being mounted on the frames, with a belt drive from a 4-in. motor pulley on to a

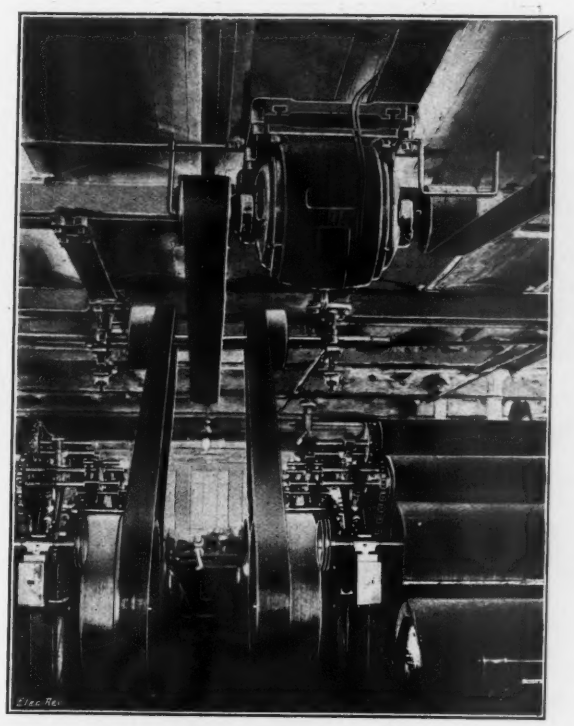


Standard Schorch Loom Motor Switch for Friction Drive.

14-in. clutch pulley geared to the loom. A small spring-controlled totally-enclosed starting switch is fitted beside the motor and a testing socket is provided on the motor to enable a portable meter to be plugged in for ascertaining the current taken.

Each pair of loom motors is supplied from a cast-iron distribution box sunk in the floor, the motor circuits being taken out through Zed fuses and carried in steel tubing up to the starters.

A main distribution cable, run in buried screwed steel tubing couples up the boxes in series to the main distribution board for the room.

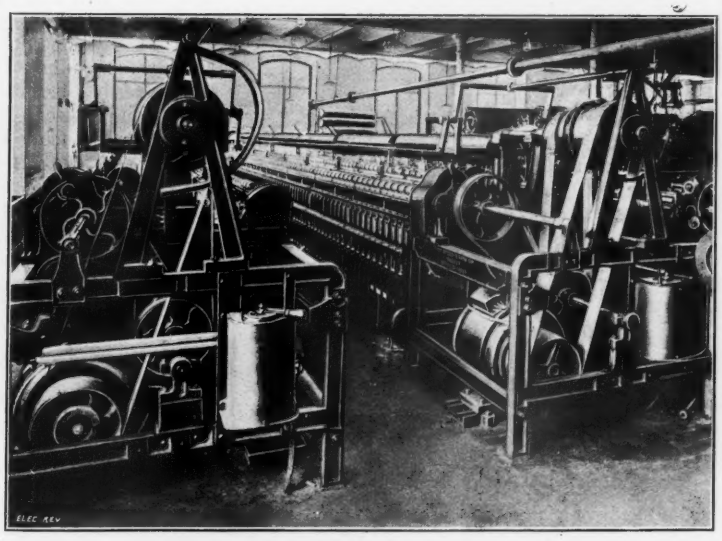


15-B.H.P. S.C. Motor driving Two Large Sets of Carding Machines.

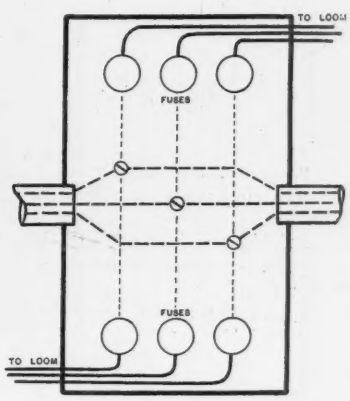
Thirteen looms of an older pattern, which it was not easy to convert to single driving, are group driven from a 12-B.H.P. motor, while on the same floor a 15-B.H.P. motor, 575 R.P.M., attached to the ceiling, drives two large sets of Yorkshire carding machines, by the Chadwick Machine Co., each set consisting of a scribbler, two swifts, a carder, and a tape condenser.

There are also five Sykes spinning frames, each with 210 spindles, and these frames are each equipped with a 7-B.H.P. motor, 980 R.P.M., giving an individual drive.

On the top floor of the mill are 18 self-acting mules, with about 4,000 spindles. In these mules the variation in speed is made on a counter-shaft, and each of the latter is driven by a 5-B.H.P. totally-enclosed motor, speed 970 R.P.M., fixed to the roof, and having a different diameter pulley at each end of the rotor shaft; it may be mentioned

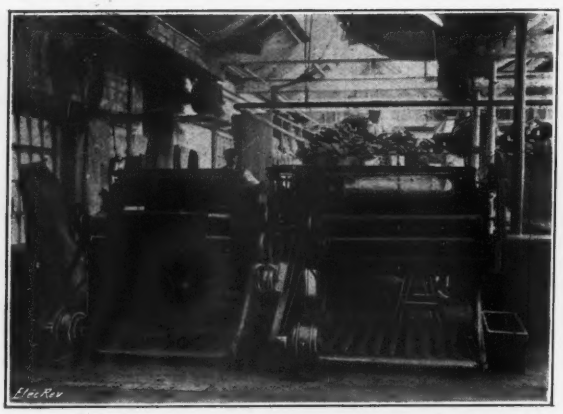


Spinning Frames, each Individually Driven by a 7-B.H.P. Totally Enclosed Motor.



Floor Distribution Box for Loom Motors (Plan).

that with the type of mule generally used, only one pulley is required for driving a countershaft, which drives the



Cloth Cutters singly driven by ¼-h.p. Motors.

mule headstock. The starting switches are on adjacent pillars, and the wiring is run in steel tubing along the roof to the main distribution board.

It may be added that the standard distribution board is of the ironclad type, equipped with Zed fuses, the latter type of fuse being used for all services up to 60 amperes; beside the above board is an ironclad terminal board containing a main switch, ammeter, voltmeter, and a watt-hour meter for checking the operation of the motors.

In another old portion of the mill a 15-b.h.p. and two 5-b.h.p. motors, all back geared, are employed in driving weaving and finishing machinery; in the finishing department there are individually driven, a Bailey steam-blowing and air-cooling machine by a 7-b.h.p. motor, a Tomlinson brushing machine by a 3-b.h.p. motor, and an hydraulic pump for supplying the cloth presses, by a 3-b.h.p. motor, while three other small motors are employed for driving, cutting and folding machines in this department.

A 5-ft. diameter Blackman fan is driven singly by a 5-b.h.p. motor, and the various machine tools in the mechanics' shop are group driven by a 5-b.h.p., 980 r.p.m., motor.

The riggling and cuttling machine, which runs at a very slow speed, is driven from a back-geared motor of ⅓-b.h.p. output; five International winding frames in another part of the mill are also driven singly by ⅓-b.h.p. motors running at 1,450 r.p.m.

The chain and box hoists have separate motors, both driving through belts on to the fast and loose pulleys of the gears.

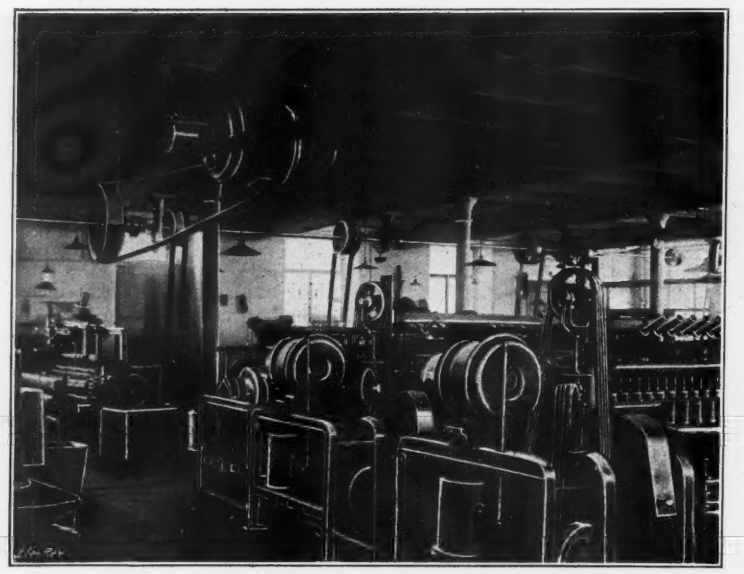
A 5-b.h.p. motor is also in use for driving the mechanical stokers of the boilers, which supply steam for the processes in the mill, and the machinery in the joiners' shop.

The motors are all wound for 220 volts, and those actually in the mill rooms are all of the totally-enclosed type fitted with ball bearings; the Schorch Co. have been exponents of the three-phase single-drive system from the beginning, and they favour a working voltage of about 220, for all small single-drive motors as being safer, cheaper and more efficient than higher pressures.

Wherever possible similar sizes of motors are installed, so that only a few spare machines, and some spare parts for the larger motors, are required. In this case only one loom motor and one mule motor are kept as spares, and, if required, a quick change over can be made in case of breakdown, which, in any event, would, with the single drive, only affect one machine.

The Schorch motors, even in the small sizes, have a high efficiency over the usual running range, a matter of extreme importance where many such motors are in continuous use all day long; on a 10-hour rating the temperature rise, despite total enclosure, does not exceed 50°-60° F. above the surrounding atmosphere, and we understand that experience with ball-bearings has been that attention and maintenance decrease with use, owing to the elimination of faulty bearings at an early stage. We reproduce some efficiency curves of small Schorch textile motors which may be of interest in this connection.

In the ordinary way the company also uses 2,500-meg. or 600-meg. grade rubber-covered cable in screwed tubing for distribution purposes up to 15 h.p., and beyond that three-core bitumum-insulated lead-covered cable cleated to the walls, &c., armoured cables being used in yards or damp places.



Twisting Frames, with 6-b.h.p. Individual-Drive Motors; also 20-b.h.p. Motor for Group Drive.

In addition to the motor installation, this mill is electrically lighted throughout, some 700 tungsten lamps being in use. We understand from Mr. J. S. Hall, the general manager—to whose courtesy we are indebted for the opportunity to visit this plant—that the change to complete electrical driving has given the greatest satisfaction, not only to the directors of the firm, but also to their workpeople; while it has obviously meant a great saving in friction load as compared with the mechanical drive for intermittently-running machines, a far more important point is the increased production, amounting to

Wool-Scouring Department; 15-b.h.p. Motor driving Scouring, Drying and Extracting Machinery.

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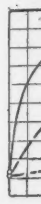

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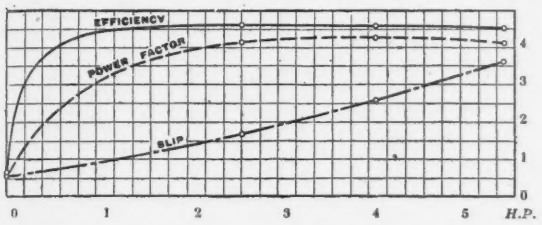
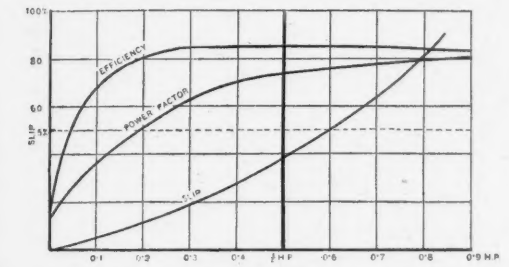
from 6 to 8 per cent., due to the even speed maintained, which has been verified in similarly equipped mills, and will doubtless be proved in this case when complete records have been secured.

There is no doubt that for the great bulk of textile



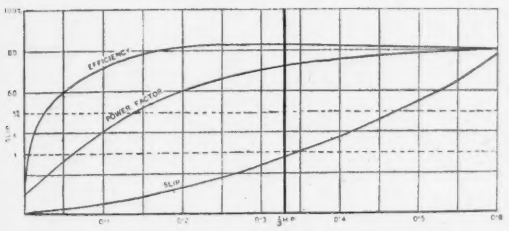
Characteristic Curves, 5-h.p. Totally-Enclosed Spinning Motor.

machinery operating under ordinary conditions there is very much to be said in favour of individual driving, and in proof of the growing appreciation of this fact, one has only to



Characteristic Curves, ½-h.p. Totally-Enclosed Motor, No-Load Speed, 1,000 r.p.m.

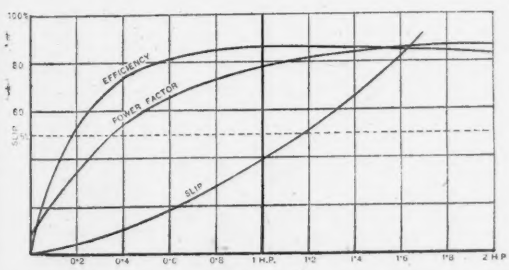
point to the installation by the allied Rochdale firms, Messrs. S. Turner & Co. and Turner Bros., Ltd., of over 1,000 Schorch single-drive motors in their mills, one



Characteristic Curves, ½-h.p. Totally-Enclosed Motor, No-Load Speed, 1,000 r.p.m.

section after another having been converted as the result of their experience.

Mr. W. R. Rothenberg, general manager of the Schorch Electrical Co., of 35, Basinghall Street, E.C., to whom we



Characteristic Curves, 1-h.p. Totally-Enclosed Loom Motor, No-Load Speed, 1,000 r.p.m.

are also indebted for assistance in the preparation of this article, informs us that the maintenance charges on an electrical installation of this kind are not more than from 1 to 1½ per cent. per annum.

CITY NOTES.—*Continued from page 448.*

Bruce Peebles & Co., Ltd.

At the fifth annual meeting, held at Edinburgh on Feb. 27th, Mr. F. E. Andrews, who presided, said that the accounts showed an appreciable advance, indicating a distinct improvement in the affairs of the company. Nevertheless, the year just completed had not been without considerable difficulties and anxiety, for in the early months they still suffered to some extent from labour troubles, and the Leith Dock Strike in June, July and August hampered their work very much indeed. Until quite recently also they had been greatly handicapped by the impossibility of obtaining reasonably quick deliveries of raw materials. Conditions such as these were bound to increase the cost of manufacture, and the contracts completed during the early months of the year were naturally very adversely affected as regards cost by the aftermath of the grievous labour disturbances of the previous year, but matters had gradually improved and settled down to a more normal course, so that the last five or six months had been much more satisfactory, the output having been greater and the works much more profitably employed. During the year, Mr. Bastow, their engineering manager, had given special attention to the internal organisation of the works with a view to cheapen the cost of production and at the same time improve the high standard of their electrical machinery. As a result, improvements had been made and economies effected whereby the establishment charges had been reduced. In a highly specialised and progressive industry such as this, however, standing charges were bound to be high, and it was impossible to reduce them beyond a certain point without impairing efficiency, so that very serious consideration had to be given before any reductions were carried out, in order to make sure that they were true economies. Any savings they had been able to make, however, were, to a large extent, offset by the cost of the National Insurance Act, which was a heavy burden without any compensating advantage to manufacturers. He was still unable to find that they derived any benefit whatever from this act, which, in its present form, was obnoxious and disliked as much by the workman as it was by the employer. For some years past manufacturers of dynamo electric machinery had been through a very bad time. Competition from foreign manufacturers had been, and and still was, very active, and a serious menace, shut out as British firms were by absolutely prohibitive tariffs from competing in their home markets. Reference to the Board of Trade returns gave some idea of the large amount of wages lost each year to British workmen by the placing of contracts abroad by municipalities and others, and would enable them to realise to some extent the tremendous difficulties with which British manufacturers had to contend owing to Free Trade policy. Then, owing to the fact that there had not been enough work to keep British factories adequately employed, such keen competition and cutting of prices had taken place that the margin of profit had been insufficient to cover normal establishment charges, let alone to give any return on the large amount of capital invested. It was a good feature to note, however, that prices, although still very low, had during the past year shown a tendency to harden slightly, and were not so absolutely unremunerative as they were two or three years ago, many of the home manufacturers having at last recognised the utter futility of the senseless and suicidal policy of taking orders at any price merely for the sake of getting them. Their own volume of work had been fairly well maintained. In the home market they had been able to secure a fair share of the orders given out during the year, and what was equally important they had obtained them at somewhat more satisfactory prices. They had given special attention to colonial and foreign trade, and the results of their persistent cultivation of the over-seas markets had been very gratifying, so that they were hopeful of a steady increase in the orders from their various agencies abroad. One of their engineers who had been in South Africa on their behalf for the last three years, came home on leave in the summer, when they discussed with him future policy and prospects. Their position and reputation in that part of the world were firmly established, and their business from that agency, which had already been quite satisfactory, was expected to appreciably increase in the near future. In the case of Canada, their friends, the Ferranti Electrical Co., Ltd., had taken steps to carry on a very active campaign in that country, and an agreement had been made between them by which their interests would be efficiently and vigorously represented. They had already been fairly successful in the amount of work obtained from that quarter, but he anticipated greatly improved results from the new arrangement.

In the annual accounts, buildings, machinery and plant stood at the same figures as before; the auditors mentioned the question of depreciation—that was a question that had, of course, had the attention of the board, and as soon as their profits permitted they would deal with the matter. Meantime, during the year, they had spent not less than £4,737 on maintenance, and ever since this company was formed they had annually expended a large amount out of current

revenue in keeping the plant and tools in a high state of efficiency. Stock, stores and work in progress amounted to £47,885, as compared with £52,282 a year ago, and this was perfectly satisfactory. The manufacturing and trading account showed a gross profit of £11,751, compared with £3,864 a year ago, and adding interest, etc., and deducting administration charges, the profit, before allowing for debenture interest, was £10,250. After paying the interest on mortgage debentures and allowing for the interest accrued on the unsecured debentures, they had a net profit balance of £2,820, which compared with a loss of £4,593 a year ago. This sum went to diminish the total adverse balance standing against profit and loss account, bringing it down to £21,675, of which amount £20,218 represented the total interest accrued to date on the unsecured debentures. Debts due to the company amounted to £53,816, and cash at bank to £10,993, making a total of £64,809, whilst the debts they owed only amounted to £25,300, as compared with £30,517 a year ago, so that their financial position was much strengthened and was quite sound and satisfactory, and substantial improvement and distinct progress had been made during the year 1913. With regard to the future—gas, whether for heating, lighting or power, was doomed—electricity was rapidly sweeping it aside. He was convinced that they were on the verge of a largely increased demand for electrical machinery and apparatus of every description, and for all purposes; from that increased demand they, in common with all other electrical manufacturers, were bound to benefit. They started the new year with a satisfactory number of orders on the books, the staff was able, hard-working, and enthusiastic, the outlook was brighter than it had been for a long time past, and he had every hope that during 1914 they would be able to improve on the considerable progress already made.

This motion was seconded by Mr. A. B. Anderson and carried unanimously, and a vote of thanks was accorded to the managers and staff.

Notting Hill Electric Lighting Co., Ltd.

The annual meeting was held on February 25th, Sir William Crookes presiding.

The Chairman, in moving the adoption of the report (see Elec. Rev., page 325), first referred briefly to the capital account and to the sale of a part of their surplus freehold property at Lancaster Road. The revenue account showed an increase of £1,338, most of which was absorbed by increased expenses. The chief increase was in the case of the current purchased from the Wood Lane Works, which was about £650 higher. That was mainly brought about by the increased price of coal, and was also due to the fact that the Wood Lane Works did not have the benefit of a supply to the White City Exhibition, which was closed during 1913. They were arranging terms for a supply to the exhibition which would be held this summer. The distribution expenses had increased by £260, and, with the £400 addition to the directors' fees which was voted at the last annual meeting, they would clearly see how the additional revenue had been expended. The net result of the account showed a total profit of £24,465, which was slightly in excess of the previous year. The depreciation, renewal, and reserve fund account now stood at £43,151, and as the machinery and mains were kept in an efficient state out of revenue, the balance of that account should be certainly more than ample to cover depreciation on the undertaking. Their property, other than land and buildings, was valued at £211,000, so that the depreciation was over 20 per cent. of it. The total contributed by the company to the Kensington and Notting Hill Joint Debenture Stock Sinking Fund had reached £51,889, and the total was now over £59,000, which was invested in trustee securities and was rapidly increasing by compound interest to meet the redemption of the joint Debenture stock which had been issued up to a total of £231,500. Most of those securities fell to be repaid when the company's Debentures were redeemed, and on that there could be no question of loss or depreciation. The statistics showed that during the year they had added over 11,000 new lamps to the circuit, bringing the total connected up to 222,350. Although they were continually adding lamps, the revenue did not increase in full proportion at present, as the old consumers gradually adopted metal filament lamps, so that a portion of the new connections went to make up the loss they sustained by the more general use of those lamps. A half-watt lamp had recently been placed on the market which was supposed to consume only a half-watt per candle-power, and when they remembered that the original carbon lamp consumed between three and four watts, it would be seen that consumers were now getting more for their money than they did a few years ago. In addition to the enormous drop in the current consumed by the lamp, the price per unit had also been reduced. He saw no reason to fear the introduction of the new lamp, as he did not think it would affect their revenue seriously for some years, as at the present time it could only be obtained in sizes for 600 candle-power, and could not therefore be adopted for private house lighting. The co-partnership scheme for the staff which was initiated in 1912 was working very satisfactorily, and the employees would each receive out of last year's profit an addition of 8 per cent. to their wages. With regard to the future, he was able to speak very hopefully, the current year showing signs of increased prosperity. He believed the revenue would increase, and the costs would probably be lower. The resignation of Mr. Schultz, their engineer and manager for the past 23 years, through ill-health, would mean a saving in expenditure, but in accordance with agreements that saving would not come into effect until next June. They might expect him to say something with regard to the application which was being made to Parliament for powers to form a bulk supply company for the whole of London. Except to assure them that the directors were very closely safeguarding the shareholders' interests and that they had petitioned against the Bill in order to ensure their being heard in the Parliamentary inquiry, he did not think it was advisable for him to say anything further on the subject.

Sir R. B. Martin, Bart., seconded the motion.

Mr. R. A. Pfungst called attention to the provision for depreciation and reserve, and said it was the general opinion amongst electrical authorities, that that company had been one of the principal offenders, especially in the past, in neglecting to make proper allocations for that purpose. If, as the board said, they had made sufficient depreciation, he would like to know how it was that other companies similarly placed had found it necessary to make much larger provision. He ventured to suggest that the dividends were only paid by neglecting to put to depreciation and reserve a proper amount.

The Chairman, in reply, said he could only repeat what he had said in his opening speech, but he would also remind the shareholders that in addition to the reserve mentioned in the balance-sheet there was the sinking fund on the Wood Lane Works, and in 1913 the company would come in for its share of those works free of cost, which would probably be worth some £60,000.

The report was adopted.

Para Electric Railways and Lighting Co., Ltd.

The annual meeting was held on February 27th at the Cannon Street Hotel, E.C., under the presidency of Mr. F. Holt.

In moving the adoption of the report (see Elec. Rev. p. 368), the Chairman, after referring to the death of Sir W. Evans Gordon, who had been chairman of the company since its inception, said that the results spoke well for the efficiency of the management in Para. The city had a population of 180,000 inhabitants, and was the principal collecting and distributing base for the export and import trade of the Amazon Valley. Their concession was for a period of ninety-nine years from 1905, after which the whole of the property reverted to the municipality without payment. The concession covered tramways, electric public lighting, commercial power, and private lighting. Briefly, the property consisted of a power house, having at present a capacity of 3,300 k.w., 12 miles of double track and 11 miles of single track, 94 motor cars and 24 trailers, a well equipped carshed, capable of accommodating 136 cars, and a complete system for the distribution of electricity for public and private lighting and power. In the past year the total gross receipts derived from working these properties suffered a reduction of 2.4 per cent to £299,925, and the operating expenses 1.8 per cent. to £164,262, the ratio of expenses to receipts working out at 54.8 per cent, as compared with 54 per cent. of the previous year, exchange having remained more or less constant. During the first four months the net earnings showed substantial increases, but from April onwards the net gross earnings began to fall off. Some statistical results for the whole year might be of interest. In the tramways department the number of passengers carried increased by 32,000, to a total of 23,254,000. Of these first-class decreased by 739,000, and second-class increased by 771,000, the result being that the gross receipts from this branch of the business decreased by 1 per cent. to £210,673, but as the operating expenses decreased by 3.5 per cent. to £119,889, the net gain amounted to £2,445. In the lighting and power department the gross revenue decreased by 5.7 per cent. to £89,251, but here the operating expenses increased 3 per cent. to a total of £44,372, the net result being, therefore, a decrease compared with the previous year of £6,684. The public were being forced to economise in every direction, and this was shown strikingly by the fact that although the number of private consumers increased during the year by 13 per cent., the gross revenue from this source, £48,200, showed a decrease of 15 per cent. The public lighting business had also undergone some change. After improved lamps had been installed, in view of the difficulties through which the city was passing, the directors decided to offer the municipality a reduction in the rate for public lighting equivalent to about £800 per month, together with a discount on all their cash payments. In friendly acknowledgment of this action, the municipality adjusted several matters which tended toward the reduction of operating expenses and smooth working, and the changes made had been very greatly appreciated by the mayor and the other authorities. For the year the municipal account amounted to £28,300. The power supply to the public for commercial motors, while still comparatively small, had increased during the year from 185 horse-power to 470 horse-power connected load. After payment of the debenture interest and sinking fund, amounting together to £38,500, there was left a balance of £102,405 for renewals, reserves, and dividends. From this balance the directors proposed to transfer £15,000 to reserve for depreciations and renewals, bringing this fund up to £72,155, and a further £10,000 to the contingen-

cies reserve, which would raise the total under this head to £40,522. The sum that they had in reserve, accumulated from earnings, at the commencement of the current year amounted to the substantial figure of £112,677, or including the carry forward, to £131,883. After transferring this £25,000 to reserves and allowing for the interim dividends, a balance of £48,305 remained, from which they recommended the payment of a further and final dividend of 3 per cent. on the Preference shares (making 6 per cent. for the year) and 5 per cent. on the Ordinary shares (making 10 per cent. for the year), leaving £19,205 to carry forward to next year's accounts, £9,000 more than that brought in. He trusted they would consider these recommendations satisfactory. The directors made them because in their opinion the earnings of the year fully justified the same dividend on the Ordinary shares as in the previous year, but they felt it their duty to point out that the immediate prospects were such that, unless a great improvement in trade took place, it might not be possible or wise to recommend the same high rate for the current year. Since April last the commercial conditions on the Amazon had been the cause of a material reduction of the receipts, but for some time before April trade in Pará had been much affected, mainly on account of the severe fall in the value of rubber. This depression increased throughout the year, and, incidentally, caused the failure of a number of important and hitherto strong commercial houses. All of this had brought about a decrease in the earning and spending power of the people. It behoved them, therefore, to be more than ever careful in the management of the business until normal times returned to the district they served. This they thought must be preceded by a readjustment of economic conditions there and an earnest effort to develop and conserve all old and new sources of trade, for it was unlikely that the people of the Amazon Valley would ever again be able to depend entirely on rubber to maintain the progress the vast valley demanded, as they had appeared willing and able to do heretofore. The first two months of the current financial year showed on their earnings the continuance of those adverse factors, as the gross receipts had decreased by £8,159, which was met to some extent by a reduction of £3,662 in operating expenses. Every effort was being made to keep these to the lowest figure compatible with the efficient maintenance of the property, and it was not only a pleasure but a duty to testify that their manager, Mr. Walter Binns, assisted by a loyal and efficient staff, had managed the property and cared for the company's interests in Pará during the past year in a most satisfactory manner.

Mr. Hubert Ansell seconded the motion, which was adopted.

Llanelly and District Electric Lighting and Traction Co., Ltd.

The annual general meeting was held on February 27th, at 66, Queen Street, E.C., Mr. A. R. Holland presiding.

The Chairman, in proposing the adoption of the report (see Elec. Rev., page 371), said that during the year the tramway, lighting, and power receipts amounted to £24,951, showing an increase of £6,000 as compared with the previous year, and it was especially gratifying to add that each of the three departments had contributed their fair and proper share to the increase. The tramways showed a very good return, and the lighting section steady progress. New customers were being constantly connected up, and when once premises were wired, the customer as a rule remained a constant customer. They had also secured additional contracts for power, and with the other negotiations now on foot he considered the prospects of the company to be exceedingly good—in fact, so good that they were now seriously considering what additional plant should be added so as to cope with the additional load they undoubtedly would have to deal with at the commencement of the winter period. Their present plant was already so loaded that, after making a fair allowance for margin, new plant was absolutely necessary. For the purpose of paying off the indebtedness already incurred on capital account, the board proposed to issue a further £15,000 6 per cent. Preference shares in the immediate future. The operating expenses naturally showed an increase, the greater part of which was caused by the extra coal consumed; and unfortunately during the year the price of coal had been exceedingly high. The new contracts recently entered into showed a fair reduction in price, which would somewhat benefit their cost sheet. In addition, the engineers were contemplating certain alterations at the power house which could not fail also to effect a material economy in the cost of current to the company. The result of the trading was that they were able to carry down £10,137 as profit for the year, which, with the amount of £2,801 brought in, made a total of £12,939, as against £9,595 in 1912. Having fairly good accounts to deal with, they considered it wise on this occasion to place to various reserve accounts £3,500 with a view to strengthening the position. He did not know that it would be necessary to put quite such a large amount to these reserves another year. £61,000 of Debenture stock had been issued and placed, a further £14,000 having been lodged with their bankers as security for a temporary loan, and naturally from the proceeds of the 15,000 Preference shares already referred to, the loan would be paid off, thus rendering those Debentures available for the other purposes of the company. On the credit side the cost of the undertaking had during the year been slightly increased by £2,877 for various capital purposes, cable, etc. The item of stock was quite normal. As regarded the debtors, on this occasion they stood at £4,015, or a little more than £800 less than on the previous occasion. This naturally arose from their local offices having now got into thorough working order, and therefore the accounts were collected more promptly.

Mr. A. H. Beatty seconded the motion, and the report was adopted.

Underground Electric Railways Co. of London.

The Rt. Hon. Sir Edgar Speyer, Bt. (Chairman), presided on March 5th at the Westminster Palace Hotel over the annual meeting of the above company.

In moving the adoption of the report (see Elec. Rev., page 370), he said he thought, considering the various factors affecting the situation, there was no reason for dissatisfaction with the result achieved. The policy of working as one unit the various enterprises in which the company was now interested had been further developed, and he could only repeat that the hope for the shareholders to get a return on their capital and for the travelling public to get the best possible service lay in the closest possible co-operation between the various transport companies. What was of importance and interest to them was not so much what each individual company had done by itself, but what the companies had achieved as a combined undertaking both for the shareholders and the public. During the period under review the companies in which they were interested had gross earnings amounting to £6,386,500. They carried the huge total of approximately eleven hundred million passengers, at an average of 1.4d. per passenger. Their total pay roll amounted to over £2,350,000, and they spent more than £1,563,000 on capital account for various improvements in order to put the transportation services of Greater London on a still higher level. To perform this service 27,000 men were employed. The company which had been the largest factor in securing the result was the London General Omnibus Co., which carried a total of over 580,000,000 passengers and whose gross passenger earnings amounted to £3,200,000. Although it had not been the policy of the Omnibus Co. to work unnecessarily competitive routes, the development of the company's services had undoubtedly prejudiced the growth of the Underground Railways, and this was unavoidable so long as there was a public demand for new motor 'bus routes. It was expected that this effect would be, in part, at least, offset by a system of working and of through tickets between the motor 'buses and the railways, and it was to secure this object that the company became interested in motor 'buses. The fact that the working results of all the companies had in the aggregate been so successful was a complete justification of this policy. The Chairman next touched on the importance of unification of services, and afterwards dealt with the report of the Select Committee of the House of Commons on Motor Traffic. Some of the recommendations embodied in the report were, he thought, sound, and could be adopted with advantage to the public, but others would in their opinion only add to the difficulties of the present situation instead of effecting an improvement. They entirely dissented from the view that the London County Council, who were interested in a competitive service of tramways, should be given wide powers of control over the working of mechanical stage carriages, even with an appeal to some new public department. They considered that the true solution of the great traffic problem of London lay in all the transport agencies being brought under one, but only one, control, which, however should be absolutely independent and impartial. As repeatedly stated, they believed the best results to the public would be secured by means of an owning, and not merely an advisory, authority. Although the Omnibus Co. had progressed more rapidly than the railways, he did not wish it to be understood that he thought the District and Tube Railways had come to the end of their development. This was, in his opinion, very far from being the case; but in order to secure better results these railways could not stand still. There was good ground for hope that all of them would benefit not only from the natural and continuous increase in the population of London and the congestion in the streets, but also from the extensions which were planned and which would be pushed forward now that the requisite Parliamentary sanction had been obtained. The Chairman next dealt with the various services in which the company was interested. With regard to the City and South London Railway, until the tunnels had been enlarged and the train service modernised no better earnings could be looked for from this railway. As regarded the Central London, the Great Western Railway was progressing with the construction of the connecting line between Shepherd's Bush and Ealing, and it was anticipated that through trains would be running between Liverpool Street and Ealing well within a year from now, and that the revenue account of the company would correspondingly benefit thereby. After the improvements referred to both in the case of the City and South London and Central London Railways had been completed, these companies should earn sufficient net revenue to wipe out any deficiencies which their company now had to meet. The London Electric commenced working a service of trains to Paddington

Station on December 1st last, and within the next two months the extension to the Embankment at Charing Cross, and the escalators at Oxford Circus, should be open for traffic. The Queen's Park extension was progressing very rapidly, and should be ready during the current year. The District Railway Co. had no large works in hand, but when the construction of the Wimbledon and Sutton Railway now under discussion was completed, the earnings of the District Railway Co. would be substantially improved. But quite independent of this extension the traffics of this railway should continue to expand. The London and Suburban Traction Co. had fully come up to expectations during the short period of its existence, and had paid a full 5 per cent. dividend on its Preference shares. The outlook for this company was encouraging, and some distribution on the Ordinary shares, of which their company held 744,324 shares, seemed now a likely event in the near future. The results of the Omnibus Co. had been quite satisfactory, and unless the normal working of the company was impeded by unforeseen circumstances there was every reason to hope that the expansion of its traffics would continue and a good net result be obtained. The Associated Equipment Co. had earned large profits compared with its small capital, and these had been obtained from three sources: The construction of chassis; the manufacture of various parts for the companies in which they were interested as well as for others; and from the operation of 'buses by the subsidiary company called the Metropolitan Steam Omnibus Company. The revenue account showed total receipts of £629,817, as compared with £494,934 in 1912, an increase of £134,883, of which £107,500 was due to the income from the company's holding of Associated Equipment Co. shares. The larger portion of the increase in the latter was due to the fact that owing to the Associated Equipment Co. having started operations on 1st August, 1912, only five months' revenue from this source was included in the 1912 revenue account. The income from holdings in the London Electric Railway Co. was £121,120, as compared with £152,124. The decrease was almost entirely accounted for by the acquisition of the City and South London Ordinary stock, the former holders of which received 40 per cent. in London Electric Preference stock and 25 per cent. in London Electric Ordinary shares in exchange for their Stock. As the income from the holding of City and South London Ordinary stock only amounted in 1913 to £1,821, there was a loss of income from this source of about £25,196. The income from holdings in the Metropolitan District amounted in 1913 to £39,900, as compared with £35,471 in 1912; that in the London General Omnibus Co. was practically the same each year, and sundry receipts amounted to £58,605, as compared with £38,383. As to the debit side of the revenue account, he need only refer to the item of £26,830 representing the amount paid on Central London Railway stocks under guarantee. Their company made itself liable to holders of Central London stock who came in under the scheme for a dividend of 4 per cent. per annum. The Central London Railway Co. only declared a dividend of 3 per cent. on its Ordinary stock, and the amount charged to revenue account represented the extra 1 per cent. paid to holders of Assented stock. The surplus for the year after paying all fixed charges and the full interest on the Underground Income bonds amounted to £42,174, as against £2,996 in 1912; these two sums amounting to £45,170 represented the balance carried forward to the current year. Having regard to the adverse factors which militated against the results of their railways, the net results of which had been materially affected by the high price of coal, the increases in wages and the improvement in the conditions of service of certain grades of employees, he thought the progress shown was distinctly encouraging. The Underground Co. had made very rapid strides during the last three years, and shareholders might therefore have expected some distribution before now. But it should be borne in mind that the various acquisitions to which he had referred had inevitably delayed this, and as was always the case with new acquisitions and responsibilities, the burdens preceded the benefits. These benefits had now begun to accrue. The company had long since completed the railway construction and equipment work which it undertook, and had disposed of its Power House to the Metropolitan District and London Electric Railway Companies. Its assets now consisted almost entirely of its holdings in stocks and shares in the subsidiary companies. The company was therefore to-day in substance a share and securities holding company, but it was not one at law, and in consequence could not declare and pay dividends without an annual valuation of its assets. Owing to the fact that in some cases these assets were unquoted and that in others only such small amounts were in the hands of the public that the dealings in them afforded no true criterion as to their value, it would cast an undue burden on the directors if they were called upon to make such an annual valuation. This could be obviated if the Company were actually turned into a holding company with wide powers, and with the approval of the shareholders the directors proposed to take this course and to alter the Memorandum and Articles of Association and obtain the necessary sanction of the Court.

Lord Farrer seconded the motion.

Mr. Walford said it had been publicly stated that the Great Eastern Railway Co. intended to electrify its lines. Would it not be possible for their company to make an arrangement with the Great Eastern Co. by which the Central London Railway could be carried on down to Walthamstow?

Sir Robert Perks pointed out that their companies were carrying the public at an extremely low rate. If they could add ½d. to the average fare per passenger on the District Railway, as they told the Parliamentary Committee they intended to do when they got their electrical powers, and slightly add to the fares of the other companies, they would have a very large increase of income, and they would then be far below the rates at which New York and Paris were carrying their passengers.

The Chairman said the suggestion of Mr. Walford would, of course, be considered. The question of raising fares was a delicate one. The policy of the Underground Railway was in the direction of low fares, and they thought the best results were to be obtained by carrying the public as cheaply as possible. They were in a different position in London to Paris and New York, as here the local authority was competing with them.

Sir Robert Perks: And losing money.

The report was adopted and the retiring directors re-elected.

British Electric Transformer Co., Ltd.

The eleventh annual meeting was held on March 5th, at Salisbury House, London Wall, E.C. Mr. A. F. Berry presiding.

The Chairman, at the outset of the proceedings, referred with regret to the continued indisposition of the chairman of the company, Mr. J. F. Albright, and said that that gentleman had expressed to him (Mr. Berry) a wish to resign from his position. In view, however, of his past services, he (the speaker) felt sure it was the wish of the shareholders that Mr. Albright should continue to act as chairman, and he would like an expression of opinion from the meeting on the subject. Proceeding to propose the adoption of the report (see Elec. Rev. p. 360), dealing first with the debtor side of the balance sheet, he said the item of sundry creditors had decreased by £3,274, which meant that the directors had followed their usual practice of getting the maximum amount of cash discount by paying their bills promptly. With regard to depreciation reserve, owing to the valuation of their freehold land, buildings, plant, machinery, and leasehold premises, it was unnecessary last year to increase that reserve, but this year they proposed to add £1,500, bringing the reserve up to £9,300. The general reserve would, with the proposed addition to it, stand at £29,245, which was a fairly substantial figure. On the credit side of the balance sheet it would be seen that the item of freehold land, buildings, etc., had been increased by £3,991, due to purchase of some freehold land adjoining their old site, in order to facilitate extensions in the future. Turning to the profit and loss account, they would see that the general charges had increased by about £1,800, which was due to extra work carried out during the year, which, he might say, had been the heaviest year that the company had ever had. By reason of the competition they encountered, the works output every year represented more actual work than in the previous year. In other words, they had to deliver a far greater output of machinery for the same amount of money. He need hardly say that they watched the general charges as carefully as they could, and he did not think it would be safe to attempt to reduce them. The gross profit of £31,920 was £3,766 higher than that of the preceding year. The item of interest and discount was practically the same, and the net profit was about £500 more. He thought the ordinary shareholders were to be congratulated on the fact that this was the third year in succession in which the directors had been able to recommend a dividend of 10 per cent., and when it was considered that they were distributing less than half the total profits available, and had put considerable sums to reserves, it would be seen that the position was eminently sound. With regard to the question of extra remuneration to which the directors were entitled, they did not think it fair either to the shareholders or themselves that it should be dependent upon the ordinary shares receiving 10 per cent. As it would take some time to call extraordinary meetings to alter the articles in that respect, the board thought that their best course was to waive their right to the extra remuneration and leave themselves in the hands of the shareholders, as a body, to vote them what extra remuneration they thought fit. In due course notice of extraordinary meetings would be sent out, at which resolutions would be proposed for altering the articles to make the extra remuneration dependent on the amount of profit earned instead of the amount of the dividend. The business during the year had shown very marked expansion as they anticipated it would. Their shipping orders were particularly satisfactory and showed considerable increases. Repeat orders followed in almost every instance where they shipped abroad, and that they considered a very good testimonial to the nature of their products. They commenced 1914 with orders far in excess of anything they had ever had before. They were in excess of those in hand for January, 1913, which were 25 per cent. ahead of those for 1912, while both 1912 and 1911 were record years in their turn, so it would be seen that their progress had been continuous. With competition always around them, it was not easy to forecast the results for the current year, but from the extended use of

electricity in this and other countries, taken with the sound condition of their business, they were enabled to hope for a proper share of orders during this and future years. Their employees, both in the office and works, had worked together this past year, as for many years past, in a way that had enabled them to give continuous employment for many years, and it was a great pleasure to see the sons of some of the workmen coming into the factory to make a start, which meant that some of them had actually worked together for just over twenty years. With regard to the question of a Stock Exchange quotation for their preference shares, the secretary had just furnished the required information to the committee of the Stock Exchange, and, in spite of the comparatively small number of these shares, he expected they would be granted a quotation for them. If the shareholders made a comparison with the results of previous years, they would find that the progress of the company had really been very marked. He had been greatly struck by some figures which he had drawn up showing those results, and he proposed to send a copy of them to the shareholders in order that they might clearly see the progress which the company had made during the last five years.

Mr. T. Rowe seconded the motion, and the report was adopted.

The retiring directors having been re-elected, a resolution was passed awarding the directors the sum of £843 as extra remuneration.

South London Electric Supply Corporation, Ltd.

The directors' report for the year ended 31st December, 1913, states that the gross receipts for the year have been £51,645, and the expenditure £23,475, leaving a profit balance of £28,170 plus £883 brought forward. After providing for depreciation on plant and machinery (£6,300), debenture and other interest accrued, etc., £14,026, there remains £15,028. Out of this a dividend at the rate of 5½ per cent. for the year on the ordinary shares, amounting to £14,300, is recommended, carrying forward £728. At the end of 1913 there were connected to the company's mains the equivalent of 302,124 (35 watt) lamps, a net increase for the year of 28,818. At present there are 310,600 (35 watt) lamps (equivalent) connected, and applications are in hand for a further 12,845 lamps. During the year the plant, machinery and mains have been maintained out of revenue in a high state of efficiency. The units sold were 5,741,226, an increase of 741,108, or 14.8 per cent. Though the total cost per unit sold was 0.98d. as against 1.0d. in 1912, the revenue per unit has decreased in a greater ratio owing to the increased output being sold chiefly for motive power. The ratio of total costs to revenue is 45.5 per cent. During the year the balance of the 5 per cent. first mortgage debenture stock was disposed of, and in order to provide the necessary capital for further extensions the directors have decided to ask the shareholders for their sanction to an issue of cumulative preference shares. They are also asking the shareholders to so alter the articles of association of the company in accordance with recent legislation, as to allow the payment of an underwriting commission. It is not proposed that the commission payable on the shares now to be issued shall exceed 2½ per cent.

Units generated	7,253,593
Sold to consumers and used by public arc lamps ...	5,741,226
Used on works	431,525
Total	6,172,751
Expended in distribution	1,080,842
Total connections in K.W., December, 1913	10,580

The meeting is to be held on March 16th.

W. T. Glover & Co., Ltd.

The directors' report for the year ending 31st December, 1913, shows that the result of the trading is a credit balance of £33,796, plus £8,326 brought forward. There have to be deducted the following:—Directors' remuneration and expenses, £1,020; interest at 4½ per cent. on first mortgage debenture stock, £4,250; interest at 5 per cent. on second mortgage debenture stock, £3,800; written off investments, £3,603; appropriation for payment to trustees of second mortgage debenture stock, £4,000; leaving £25,448. Out of this are paid the following:—Dividend on 5 per cent. cum. preference shares, £4,708; first mortgage debenture redemption fund, £2,500; dividend on ordinary shares at the rate of 5 per cent., £5,407; bonus on ordinary shares, at the rate of 2½ per cent., £2,704; to reserve fund, £5,000; leaving to be carried forward, £5,128.

After making the above appropriations, the redemption fund for the first mortgage debenture stock will stand at £35,500, the redemption fund for the second mortgage debenture stock at £28,000, and the reserve fund at £25,000. The Trafford Power and Light Supply (1902) Ltd., of which this company holds the majority of shares and also a second debenture for £25,000, have agreed to sell to the Manchester Corporation their concession and entire business of generating and supplying electricity in and near Trafford Park, subject to the necessary sanction being obtained from Parliament during the 1914 session.

The meeting is called for March 16th.

North Metropolitan Electrical Power Distribution Co., Ltd.

The directors' report states that the revenue for the year ended December 1913, amounted to £19,479, an increase of £1,633. The balances from the local revenue accounts amount to 7,273, plus sundry receipts and £291 brought forward. Deducting administration and promotion expenses, and debenture interest, there remains £5,327, which is to be appropriated thus: To renewals fund, £1,000; to reserve, £1,000; to ordinary dividend (6 per cent. per annum), £3,000; to be carried forward, £327.

The expenditure upon capital account during the year was £3,503, of which £2,782 was in respect of extensions of mains and installations upon consumers' premises.

The revenue for the year from Barnet electric supply was £6,035, compared with £5,639 for 1912. The installations connected at December were 23,300 30-watt lamps.

The revenue from Enfield electric supply for the year was £4,469, compared with £3,821 for 1912. The installations connected at December last were 23,300 30-watt lamps.

The revenue from Hertford electric supply for the year was £3,998, compared with £3,820 for 1912. The installations connected to the mains at December were 22,200 30-watt lamps.

The revenue from St. Albans electric supply for the year was £4,858, compared with £4,334 for 1912. The installations connected to the mains at December were 24,650 30-watt lamps.

The additional connections made during the year in the four districts represented 3,000 30-watt lamps, making a total of approximately 93,450 30-watt lamps. The units sold were 1,440,024, compared with 1,337,157, an increase of approximately 8 per cent. The company have during the year under review lost some important consumers who are now supplied direct by the North Metropolitan Electric Power Supply Co. The Barnet E. L. (Extension) Order, 1913, received the Royal Assent on 15th August, 1913.

An agreement has been entered into with the corporation of Hertford, whereby the first date of the purchase of the undertaking authorised by the Hertford E. L. Order, 1891, has been extended from 1912 to 1923. The company is, jointly with the North Metropolitan Electric Power Supply Co., promoting in the next session of Parliament a Bill to confer further powers upon both companies. Mr. George Offor has resigned his seat on the board, and Mr. A. L. Barber has been appointed in his stead.

	Barnet.	Enfield.	Hertford.	St. Albans.	Total.
Units purchased ...	576,348	291,753	290,130	397,682	1,555,913
Units sold—Public lamps ...	51,213	—	7,384	—	58,597
By contract ...	306,535	55,572	103,257	188,033	653,397
Private consumers, by meter	150,792	221,927	159,731	195,580	728,030
Total sold ...	508,540	277,499	270,372	383,613	1,440,024
Total not accounted for ...	67,808	14,254	19,758	14,069	115,889
Public lamps ...	201	—	31	—	232
Maximum supply demanded ...	295K.W.	218K.W.	168K.W.	257K.W.	—

The meeting was held on March 5th.

Scarborough Electric Supply Co., Ltd.

At the annual meeting held a Scarborough on February 28th, Mr. G. Alderson-Smith, in moving the adoption of the report (see Elec. Rev., page 366), said that next August they would come of age and be twenty-one. The report was not perhaps as satisfactory as they could have wished, but still it was an improvement. As far as he could see, they had rounded the corner. The capital account showed that last year they spent £717, but they put £1,000 to that account, so that they were to the good there. The capital account really stood at £114,000. Of that £14,000 had been paid out of revenue account, and they had simply to pay a dividend on the £100,000. Turning to profit and loss account, they had an increase on the sale of electrical energy of £515, and on the sale of lamps of £109. There were other smaller increases, but coal had cost them £323 more. They had in stock some 230 tons of coal against strikes or other emergencies. The balance was £300 more than for the preceding year, and they were carrying forward £847 against £401.

Mr. A. A. Campbell Swinton, M.Inst.C.E. (managing director), in seconding, said he was in touch with, he thought, something over forty different electrical undertakings of this character in various parts of the country, ranging from Inverness to Cornwall. During the past few years all these electrical undertakings had been going through more or less the same experience. The advent of the metallic filament lamp in all cases produced a great drop in revenue, followed by a more or less rapid return to the previous position. Scarborough unfortunately had been much slower in its return to prosperity than any of the other concerns with which he was connected. He thought they might take it that they were now on the upgrade, and that they were at least making a sufficient amount of new business to make up the loss of revenue due to the less amount that each individual consumer paid. All these electrical undertakings were on a sounder basis now than before, because they had more consumers and each consumer paid a little less. They were on a sounder basis because they were in a better position to compete with the incandescent gas mantle.

The report was adopted without discussion, and a dividend of 3 per cent. was declared.

In referring to the retirement from the board of Mr. Simpson, Mr. Campbell Swinton remarked that that gentleman was a large shareholder, and the board would still have the advantage of his advice with regard to coal contracts.

Rhondda Tramways Co., Ltd.

The annual meeting was held on March 5th at the offices, 3, Laurence Pountney Hill, E.C., Mr. L. B. Schlesinger, the chairman, presiding. The proceedings were private, but from the directors' report which was supplied us, it appeared that the balance to credit of revenue account for the year ended December, 1913, was £27,686, plus £1,976 brought forward. From this had to be deducted: rent to the Rhondda Urban District Council £2,255, debenture interest paid and accrued £11,690, sinking fund for redemption of debentures £2,710, written off uniforms £222, written off furniture, fittings, plant and tools (10 per cent.) £191, leaving a balance of £12,593. The directors recommend that there be put to reserve and renewals account (bringing it up to £14,000) £4,000 dividend on preference shares, being the full dividend of 6 per cent. for 1912, and 2 per cent. on account of 1913, £8,000, carrying forward £593. The powers for construction of a railless traction system to connect the tramways with the rapidly developing mining districts of Tonyrefail and Gilfach Goch were authorised by Parliament, and the construction of the system was about to be started. The results for 1913 cannot be compared with those for 1912 without taking into account the coal strike and the strike of the company's own employees in that year.

	1912.		1913.
Gross revenue	£50,859	...	£65,241
Traffic revenue	£49,778	...	£63,721
Profit before providing for debenture interest, reserves and depreciations, etc.	£18,680	...	£27,686
Passengers carried	9,035,974	...	11,660,230
Car miles run	1,093,584	...	1,311,408
Average receipts per car mile	10.92d.	...	11.66d.
Average receipts per passenger	1.32d.	...	1.31d.
Cost of energy per car mile	2.18d.	...	2.35d.
Percentage of operating costs to traffic revenue	64.67	...	58.94
Percentage of operating costs to total revenue	63.26	...	57.56

Lot's Road Power House Joint Committee.

A meeting of the holders of Metropolitan District and London Electric Railways' Joint Power House Rent Stock Charge was held on Monday, March 2nd, at the Westminster Palace Hotel, Mr. W. M. Acworth presiding.

The Chairman explained that the object of the meeting was to ask their approval of an increase of the Power House Rent Charge Stock. On January 15th, 1912, the purchase of the generating station and the statutory lease to the two railway companies were duly carried out, and the joint committee then created had issued £2,250,000 4 per cent. Joint Power House Rent Charge Stock. Since that date the generating station had been worked by the two railway companies for the supply of all electric current used on their railways, and also for supplying current to certain other railway companies and consumers whom they were authorised to supply. For the year ended December 31st, 1910, the output of the generating station was about 130,000,000 Board of Trade units, while for the year ended December 31st, 1913, the output amounted to not less than 156,000,000 units. Certain extensions of the railways of the two companies were under construction which, when completed, would require an additional supply of current. In order to provide for this increased output, and for other supplies which the two railway companies were authorised to furnish, and which they saw their way to supply on remunerative terms, and in order also to ensure greater economy in working, the two companies, with the consent and at the charge of the joint committee, were proposing, and had, in part contracted for, certain enlargements and extensions of, and additions to, the generating station undertaking. The estimated cost was about £216,000. The principal additions included a large tank for the storage of a reserve supply of coal, injection and overflow pipes to the river Thames for cooling water for condensers, and further generating plant (including two 15,000-k.w. turbo alternators). It was proposed to raise this sum of £216,000, together with the amount required to pay the stamp duty on the further stock and other expenses, by the issue of the requisite further amount (not exceeding in all £250,000) of Joint Power House Rent Charge Stock, which would rank in all respects *pari passu* with that already issued. Under the Act and the statutory lease of the generating station undertaking to the two railway companies, the rent payable by the companies to the joint committee automatically increased by the amount of dividend payable on any further issue of rent charge stock as and when issued. The issue of new stock therefore did not impair the security for the existing stock, and he would point out that under the provisions of the Act all enlargements, extensions, and additions to the generating station undertaking would, upon completion, be comprised in the lease granted by the joint committee to the two railway companies. The rent which covered and guaranteed the dividend on all the stock for the time being issued, was payable by the two railway companies in equal moieties as part of their respective working expenses, thus the stock already issued and the proposed further issue were abundantly secured, as they ranked in front of the entire net revenue of the two companies. The additional outlay had, after careful consideration, been sanctioned by the respective boards of the two railway companies, and approved by the joint committee, who considered that it was desirable, in view of the recommendations received from Messrs. Merz and McLellan, their electrical advisers, that in the interests both of the railway companies and of the joint committee, the sanction of the stockholders should be given. He concluded by proposing a resolution to this effect.

Sir Algernon West seconded the resolution, which was carried by the requisite three-fourths majority, Mr. Mandelick, the secretary, stating that either in person or proxy, the votes in favour of the resolution represented a total of £493,410, and those against £5,500.

Bath Electric Tramways, Ltd.

The annual meeting was held on March 4th, at Winchester House, E.C., Sir James Sivewright, K.C.M.G., presiding.

In moving the adoption of the report (see Elec. Rev., page 360), the Chairman said that the year just closed was without exception the best which the company had ever had, both in the mileage run and in the traffic receipts, and in the net earnings. Fortunately the weather, upon which the whole success of the company depended, had been good. The motor omnibuses, which formed a prominent and increasing feature of the business, had had an excellent season, and the prospects were better than they had been; already they had got orders running into £1,000 for the summer season. The net profit for the year was £2,354 more than for the preceding year, and he only hoped that their profits would be equally good this year. In regard to working expenses, they could claim to have maintained their usual excellent record. Taking 22 other tramway companies, their working expenses for 1912 averaged 15.98d. per car mile, and those for 81 local authorities which possessed tramways were 6.68d. In their case their working expenses, which included administration, worked out at only 5.32 per car mile, which, he thought, was a testimony to the work of their general manager. With much that was satisfactory there was a very serious problem before them on which naturally there was a good deal of difference of opinion. The shareholders had received particulars of a scheme to provide for the future of the company, and he wished to make it quite plain that the board had only one object in view, and that was the interests of the shareholders. For many years past they had owed their bankers a very considerable sum of money. That money had been spent upon capital, and they looked forward to repaying the loan either by raising Debentures or by the issue of Preference shares or in some other way. Time ran on, and they had paid substantial amounts off the loan out of capital, but at last the bank was extremely urgent, and said that such a permanent loan was not a banking matter, and the board also found that they were crippled for lack of capital, and that they could not extend their motor omnibus service to the extent that the public demanded. They therefore approached the bank, and they allowed them to suspend the repayments for a time out of revenue, and they had been putting the money into motor omnibuses, which at the present time were yielding a magnificent profit. It was apparent, however, that that condition of things could not go on indefinitely, and the board had tried their very best during the last two years to obtain financial assistance, but the terms which would have been exacted were of such an onerous character that they absolutely declined to entertain them. They were told by some that they could get the money by prior lien bonds. He, however, was perfectly certain that the Preference shareholders would not agree to such a security being placed in front of them. Then it was suggested that there should be an assessment of all the shareholders. He deprecated that course because it would possibly have meant that many of the shareholders would have been unable to meet the call and their shares would have been forfeited. He wished to make it clear that the scheme had not emanated from the company's auditors as had been stated in certain quarters. It emanated from their local director in Bath, Mr. Clutterbuck, in conjunction with the general manager. The board called in the auditors to confer with them; they laid their plans before them and the scheme was their joint production. It was a drastic scheme, there was no doubt about that; but they believed most firmly that it was in the best interests of the company and of every stockholder, debenture-holder and shareholder alike. The bank was quite satisfied with it as it repaid their loan over a term of years and it also provided for the relaying of the track. In ten years' time certainly, probably before, they would have to commence that work, and a very moderate estimate of the cost was £30,000. The figures on which the board had worked in framing the scheme were most conservative. They had suggested the suspension of the preference dividend for four years, but it was a cumulative dividend and would undoubtedly be paid. It was said that they were favouring the preferred ordinary shareholders by the scheme, at the expense of the preference shareholders. That was not so. The preferred ordinary shareholders had stood by and seen their dividends go into capital for a good many years past for the repayment of the bank loan, and by that means the position of the debenture-holders and preference shareholders was strengthened, and their dividend was pushed further off by the scheme for it was not cumulative. He (the chairman) held £10,000

preferred ordinary shares and he did not hold one preference; but he was satisfied in his own mind that it was to his advantage as a preferred ordinary shareholder to agree to the scheme and that one day his stock would be valuable. As showing how conservative they had been in their estimates, he might mention that they had estimated the revenue for the current year at £1,300 less than the actual earnings for the past year. If the earnings should come up to last year that gave them £1,300 for payment of a portion of the preference dividend. Supposing they were lucky enough to earn £2,400 more this year than last they would be able to pay nearly the whole of the preference dividend, for they intended to make a saving of £400 a year by reducing the board from five to three. He was extremely sanguine that the preference dividend would not be suspended altogether; but that they would be able to pay a portion of it and before four years had passed he believed they would be paying a good proportion of it. They had received promises of support to the scheme from a very large number of shareholders, and out of £75,000 preference capital they had received promises of support amounting to £13,428.

Mr. H. F. Clutterbuck seconded the motion and the report was adopted.

The Chairman then formally proposed a resolution approving of the scheme as set out in his speech.

Mr. Clutterbuck, in seconding, said that at first he was strongly opposed to the idea of waiving the preference dividend for even two or three years because the company had a successful tramway doing good business. They had, however, taken the best expert advice they could get and it appeared to him that if they were to continue as they were, in the long run they would be doing far greater injustice to the shareholders than they were by facing the position now.

Considerable discussion ensued in which several shareholders asked the board to adjourn the matter in order to see whether it was not possible to arrive at some scheme whereby the preference dividend would not have to be waived, and eventually the chairman agreed to adjourn the matter for at least three months, on the understanding that in the meantime the directors would be pleased to give consideration to any proposals that shareholders might make.

Bournemouth and Poole Electricity Supply Co., Ltd.

The directors' report for the year ended December, 1913, states that the capital expended during the year amounted to £3,819, making the total £473,397. The balance from revenue account for the year, after deducting generation and distribution costs, rent, rates, taxes, wages, directors' fees, general establishment and other charges, and proportion of salaries, was £39,452, plus £2,144 brought forward, making the total amount available £41,596. From this there are deducted: Interest on debenture stock and interest on temporary loans, less income tax, £9,723; leasehold and special redemption funds and interest, £1,829; amount written off suspense accounts, £358; amount carried to reserve for depreciation, etc., £6,000; leaving available for distribution for the year, £23,686. After paying the 4½ per cent. and 6 per cent. preference dividends, a final dividend at the rate of 9 per cent. per annum is declared for the last half-year, in addition to the interim dividend at the rate of 5 per cent., and there remains a balance of £2,145 to be carried forward.

The total applications received at the 31st December last amounted to the equivalent of 8,790 K.W., an increase of 545 K.W. for the year. The total number of units sold for all purposes was 3,668,007. The directors of the Richmond (Surrey) Electric Light and Power Co., Ltd., have declared a dividend of 6 per cent. on their ordinary shares.

Units generated	4,721,639
Units sold—Public lamps	20,891
Private consumers, by meter	3,647,116
Total sold	3,668,007
Used on works	381,857
Total accounted for	4,049,864
Not accounted for	671,775
Public lamps	131
Total maximum supply demanded	2,692K.W.

The annual meeting was held yesterday.

Newcastle-on-Tyne Electric Supply Co., Ltd.

The annual meeting was held in Newcastle on 6th inst., Dr. J. T. Merz, chairman, presiding.

In moving the adoption of the report (see Elec. Rev. p. 403) the Chairman said the ordinary business of the company had progressed satisfactorily during the past year. The h.p. connections had increased by 29,349, which compared with an increase of 22,700 in the preceding year. The horse-power connected cost £5 18s. 5d., as compared with £7 7s. in the previous year. Their total profit of £141,000 was £20,000 more than in the preceding year. Their capital expenditure had been £174,000, and of this £19,000 had been spent on the Dunston power station, which was only the beginning of large extensions which the company would have to carry out there during the year to meet the demands. £41,000 had been spent on mains, £35,000 on sub-stations, and £79,000 had been spent in acquiring the assets of the Durham Collieries Electric Power Co., Ltd. The latter company started with Parliamentary powers to supply electricity by private wayleaves in the centre of congested coalfields in the County of Durham, and at a time when the opinion as to the low cost at which electricity could be produced was exaggerated. The promoters of the company offered to supply electricity in their neighbourhood to colliery owners at prices which were considerably below the level of prices at that time. To induce custom the prices were considered ridiculously low, but they had the effect of bringing down the price for power considerably—at least 25 per cent. below what it should have been at that period. The consequence was that damage was done to the electric power business as a whole, and the company did damage to itself, because it found it could not make the business pay. The company got from bad to worse, but the colliery owners who had contracted with it had very judiciously inserted a clause in their agreement to the effect that if the company was not able to supply them, they (the owners) were to be allowed to take the power station into their own hands and work it themselves. The colliery owners ultimately asked the Newcastle Electric Supply Co. to supply them as being the most experienced producers of electricity, and to work the station for them, and, if necessary, to supplement the production through the company's own mains. An agreement was entered into which gave the company a substantial profit. The Newcastle Co. assisted the Durham Collieries Co. with capital and also became part owners of the power station by adding to it a certain amount of plant. It was afterwards suggested that the Newcastle Co., being interested in the supply of electricity in Durham county, should acquire the assets of the Collieries Co., and negotiations were afterwards completed at a figure which was considered satisfactory. The business of the Durham Collieries, Ltd., cost them £148,000, and it brought in a revenue of £46,500. The assets in the Durham Collieries included shares in the Houghton-le-Spring Lighting Co., which had a provisional order. The Houghton Co. had a capital of about £15,500, and its business was increasing. The chairman, speaking of the financial position of the Newcastle Co., said that during the year they had made an issue of £400,000 second debenture bonds bearing interest at 5 per cent. Of the profits, £10,000 of the increase had been placed to reserve, increased dividend represented £5,000, and the remainder went to increased interest. As to upkeep and repairs, £66,000 had been spent this year over their whole system, and in the last ten years something like £340,000 had been spent, which had kept the system at the highest point of efficiency. The cost of producing electricity at the present time was lower than it had ever been.

Dr. Merz next spoke of the directors' proposal to acquire the shares of the County of Durham Electrical Power Distribution Co. The first reason for the proposal was, he said, purely local or geographical. The Newcastle Co. already had a large interest in the Durham County Co., and had also a large amount of property in generating stations and mains, which enabled them to supply electricity through the Durham Co., and to reach the waste heat stations, which constituted a very important item in the Newcastle Co's. business. The Newcastle Co's. capital over the whole Durham area amounted to £619,000. This showed their financial interest in the county. The progress of the Durham Co. had been slow, and the Newcastle Co. had helped it as far as possible. The Durham Co. was their largest consumer, a further important point of interest. They got £119,000 from the Durham Co. last year, or 26 per cent. of their total revenue. If the shareholders lost that customer all at once they would lose all the money they now enjoyed in the form of ordinary dividend. In addition, the Newcastle Co. owned nearly £49,000 of the Durham Ordinary stock, and shareholders in the Newcastle Co. held £183,600 in the aggregate in the Durham Co. The Durham Co. was now managed under dual control, the distribution of electricity being carried out by the Newcastle Co. The scheme for acquiring the shares in the former company had been framed by a committee of three directors from each company, and the figures as set out in the memorandum were considered fair to both parties.

Mr. J. H. Armstrong seconded the adoption of the report, and said it was not that Co's. intention to spend a large sum of money on developments in the Durham area, but they would meet developments as they came on. It was not their idea to go in for huge developments. The Durham Co. had been progressive so far as development was concerned, but of the gross profits the greater benefits had gone to the Newcastle Co.

The report was adopted.

The proposals for acquiring the shares of the County of Durham Co. were confirmed, as also was the following recommendation:—"That each of the existing £5 preference shares in the capital of the company whether issued or unissued, be sub-divided into 5 preference shares of £1 each, and that each of the existing £5 ordinary shares in the capital of the company, whether issued or unissued, be sub-divided into 5 ordinary shares of £1 each."

Japan.—The amount of new capital invested in electrical companies in Japan during January last is returned at £219,000, £30,000 being in connection with newly-organised concerns, and £189,000 for the extension of existing undertakings.

Madras Electric Tramways (1904), Ltd. — The accounts for the year ended December 31st, 1913, show a gross profit of £21,345. After debiting interest and London office expenses, making provision for the debenture stock sinking fund, and transferring £7,000 to the depreciation and renewal fund (being an increase of £2,000 on amount transferred in 1912), there remains a balance of £9,121, plus £3,432 brought forward, making £12,553. Out of this it is proposed to pay 6 per cent. per annum on the preference shares, absorbing £5,869, 5 per cent. per annum on the ordinary shares, £2,863, and to write off from the cost of issue of new preference shares £500, leaving to be carried forward £3,321. The traffic receipts, which show an increase of 7·71 per cent. upon 1912, continue to develop satisfactorily, and further rolling stock is being provided. The undertaking has been maintained, as heretofore, out of revenue, and special improvements and renewals have been debited to the depreciation and renewal fund, as formerly. The reserve arising from the debenture stock sinking fund now amounts to £5,424. During the year 2,640 additional 6 per cent. cumulative preference shares were allotted, the total number issued being now 20,000. The meeting was held yesterday.

The Mackay Companies.—The annual report states that the Commercial Cable Co. is engaged in a further suit against the Newfoundland Government for repudiation of a contract, the Government, notwitwstanding the company's legal victory when the case was referred to the British Privy Council, having declined to carry out the provisions of the contract. A substantial increase has been made in reserves, and extensions have gone on as usual without the issue of obligations or the use of any portion of the reserves. The Gott invention, by which the companies' submarine cables and landlines may be joined at will into one continuous circuit, and the whole operated by Morse instruments in the Morse code, is in daily use.—*Financial News.*

Hadfields, Ltd.—The directors of this company (which last year changed its name from Hadfield's Steel Foundry Co., Ltd.) in their report for 1913, state that they propose to add £15,000 to the reserve and renewal account and carry forward £50,469. In addition to the interim dividend of 1s. per share paid in August last on the ordinary shares, a further dividend is to be paid on the ordinary shares of 2s. per share, together with a bonus of 1s. per share. The directors record the death of Mr. Benjamin Freeborough, one of the first directors of the company.

Melton Mowbray Electric Light Co., Ltd.—Mr. W. J. New presided at the annual meeting held last Friday. The directors reported that the revenue for the year, including a balance of £411 brought forward, amounted to £3,065, and after providing £1,000 for debenture interest, there remained £2,065 available for distribution. A dividend at the rate of 3½ per cent. per annum was recommended, placing £750 to reserve fund for renewal of plant, and carrying forward £615. The chairman referred to the substantial reduction of the fuel account.

Automatic Telephone Manufacturing Co., Ltd.—According to a financial daily, the profit for 1913 amounted to £22,941, against £13,498 for the preceding year. After payment of preference dividend and writing off £8,000, against £1,313 a year ago, there remains £3,000 to be carried forward, against £370 brought in.

Canadian General Electric Co., Ltd.—A quarterly dividend of 1¾ per cent. for the three months to March 31st (at the rate of 7 per cent. per annum) on the common stock is announced.

Alley & MacLellan, Ltd.—Dividend on ordinary shares 6 per cent. per annum, carrying forward £1,741. For depreciation, £5,012 was written off, and £6,000 was put to reserve.

STOCKS AND SHARES.

Tuesday Evening.

Monday in this week was one of the most depressing days that the Stock Exchange has seen for months. Apart altogether from the fact that it poured with rain from start to finish, there was fairly heavy liquidation in the Stock Exchange as well. Ulster at home, Brazil, Mexico and the United States abroad, were given as the principal causes for the prevailing depression, and for the unwillingness of capitalists, small or large, to come forward with any buying orders.

We reproached a partner of one of the biggest financial houses in the City for not supporting the particular markets in which his firm are interested, but he protested that they had already done so, though all their energies were wasted. Some men said that there was a wet blanket over the Stock Exchange, while others called it "dry rot"; whichever designation may be the more correct, it is certain that the bears were in possession of the field at the beginning of the week; though the sharp recovery which occurred on Tuesday from the lowest prices touched went some way towards wiping out the previous falls.

Mr. Asquith's speech was read as a sign that all danger of civil war in Ireland could be regarded as over. Upon this, and fresh indications of money's remarkable easiness, came substantial rallies in most of the markets, optimism once more raising a timid head.

Electricity Supply shares are mostly steady, in view of the latest development which has arisen, namely, the possible formation of another group composed of certain members of the London supply companies for the purpose of presenting a Bill of their own, as distinct from that initiated by the County of London Company to come shortly before Parliament. This was an unexpected step; and, pending further details, those in the Stock Exchange who are mainly interested in the matter are cautious in their expressions of opinion. The idea of a super-company, however, on the lines already mooted, did not meet with whole-hearted approbation.

The County of London Company has decided to make a fresh issue of new Ordinary shares at 11½ and of new Preference shares at £11. As the existing quotations are 12⅝ and 12 respectively, these prices including dividends of 9s. and 6s. per share, no doubt the proprietors will subscribe readily enough. The South London Company, in its report issued early this week, gives notice that at next Monday's meeting resolutions will be submitted for increasing the capital by the issue of 12,000 new £5 Preference shares; while the South Metropolitan may be asking for fresh capital before long.

It is possible, too, that there may be some kind of issue made to deal with the electric lighting at Hendon and its vicinity; while there is a somewhat ambitious scheme on foot in connection with the supply of power to a number of provincial centres where electricity may be said to have scarcely emerged from the stage of infancy. Of this last-named project, however, there will probably be more to say by-and-bye. Westminsters and Kensingtons are rather easier on the week, and Charing Cross "City undertaking" Preference fell ⅛. On the other hand, rises have been secured by Edmundsons' Preference and South Metropolitan Preference, while several of the Debenture stocks are advanced. Bournemouth and Poole Ordinary rose 10s. on the increased dividend, and on a slight demand, to supply which, however, there were no shares offering.

The railway group showed pronounced weakness, Ordinary, Preference and Debenture stocks all giving way, but in Tuesday's improvement, this market shared to the full. Underground Electric shares dropped to 2⅞, a fall of 5s., to recover to 3¼, and the Income Debentures lost 1 on balance, holders being disappointed with the speech made by Sir Edgar Speyer at the meeting last week, when he presented masses of interesting statistics, but did not indicate when the company's shares might be likely to come into receipt of the dividend. The 6 per cent. First Income Debenture stock is also a point lower. City and South London Junior Preference stocks are flat; to pay the full dividend on the 1903 Preference, the sum of £7,400 has been debited to capital account.

British Electric Traction issues show falls, with the exception of the two Debenture stocks, both of which are a point higher. The six different kinds of securities seem to be a nuisance to the market, and this may give point to the whisper of a possible reorganisation of the company's capital account. If there be any truth in it, the hope may be permitted that another scheme would be so worked out as to do away with the present cumbersome arrangement, by the substitution of one single security for some of the existing stocks.

The American market has furnished one of the principal reasons for depression in the Stock Exchange, by consequence of some of its shares falling with unexpected rapidity. This induced realisations from some of the Continental bourses, and, sympathetically, Canadians have been affected. British Columbia Electric Deferred dropped 6 points, the Preferred Ordinary and the Preference stock 1 and 2 points each. Shawinigan Water is 2 down, though the company's First Mortgage bonds at 108 are 1 better. Montreal Common stock, after its rise of 5 last week, reacted 3 points.

The Mexican débâcle, of course, added emphasis to the uneasiness already prevailing. Mexico Trams are 1 down, and Mexican Light and Power Common shares fell 1, though several others in this group have hardened—notably Mexican Light and Power bonds, and Mexico Tramways Firsts. Brazil, too, has a crisis of its own, and in a severe slump which overtook Brazilian Government bonds and other securities connected with that country, Brazil Tractions receded to 85, a fall of 4½, from which came recovery to 87. Para Electric Preference are ¼ down, and sharp falls took place in the bonds of the Rio Tramways and the Sao Paulo Tramways Companies. River Plate Ordinary stock added another 10 points to its rise of 18 early this month, the quotation at present being 240 middle—which, by the way, makes the 6 per cent. non-cumulative Preference stock look cheap at its present price of 105½ middle, at which the yield, allowing for accrued interest, is nearly 5¾ per cent. on the money. The next dividend is payable at the end of April.

The Telegraph market is quiet, although several of the principal securities have been adversely affected by the severe falls in American Rails. New York Telephone bonds, for instance, are ¼ lower, and the Anglo-American Telegraph group has given way. Marconis have been flat, dropping to 3¼ at one time, though the loss was more than regained. The Preference are $\frac{3}{16}$ higher. Oriental Telephones at 2⅛ are $\frac{1}{16}$ harder.

In the Manufacturing division, Brush 4½ per cent. First Debenture stock recovered most of its dividend, rallying to 41, but the Second Debenture remains at 25. British Thomson-Houston Debenture is firmer, and, amongst the shares, British Aluminium Ordinary hardened to $1\frac{3}{16}$. India Rubbers fell to 11. Electric Constructions went back a trifle, and Castner-Kellners eased off to $2\frac{3}{32}$. The market, as a whole, is uninteresting. The Rubber share market, like most of the others, has been depressed, and the listing of 1,200 tons at the Mincing Lane auctions this week was sufficiently heavy to cause a little promiscuous selling of the principal shares. But the sales went better than people expected, and the Stock Exchange put up prices of most of the leading issues, giving the market a firm appearance.

SHARE LIST OF ELECTRICAL COMPANIES.

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations March 10th.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	..	7/16 — 15/16	..	Nil
Do. 5 % Pref.	1	5	5	3/4 — 13/16	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
B'ham. Elec. Trac., 6 % Pref.	100	..	..	15¼ — 17½	— ¼	..
Do. Do. Deferred	100	..	..	6¼ — 8½	— ¼	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	89 — 92	—1	6 10 5
Do. 7 % Non-Cum. Pr'f.	100	8	..	56 — 59	—1	5 1 8
Do. 5 % Perp. Deb.	100	5	5	95 — 98	+1	5 2 0
Do. 4½ % 2nd Deb.	100	4½	4½	80 — 85	+1	5 8 5
Central London Railway, Ord.	100	3	3	57 — 62	..	4 16 9
Do. Gtd. Assented	100	..	4	80 — 82	—1	4 17 5
Do. Pref.	100	4	4	68 — 73	..	5 9 7
Do. Gtd. Assented	100	..	4	82 — 84	..	4 15 3
Do. Def.	100	2	2	57 — 62	..	3 4 6
Do. Gtd. Assented	100	..	4	79 — 81	—1	4 18 7
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	95 — 97	..	5 3 1
Do. Do. 1896	100	5	5	95 — 97	..	5 3 1
Do. Do. 1901	100	5	5	89 — 92	—3½	5 8 8
Do. Do. 1903	100	5	5	89 — 92	—2½	5 8 8
Do. 4 % Deb.	100	4	4	88 — 90	..	4 9 0
Hastings Trams, 6 % Pref.	1	6	6†	3/4 — 15/16	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	67 — 72	..	6 5 0
Isle of Thanet Trams, 5 % Pref.	5	2½	3	2 — 2¼	..	6 0 0
Do. 4 % Deb.	100	4	4	71 — 76	..	5 5 3
Lancashire United, 5 % Deb.	100	5	5	85 — 87	..	5 15 0
London and Suburban, Ord.	1	..	..	1/16 — 1/8	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	1/16 — 1/8	..	6 16 4
Do. Do. 4½ % 1st Deb.	100	4½	4½	79 — 84	..	5 7 2

NAME.	Stock or Share.	Dividends for		Closing Quotations March 10th.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
London Elec. Railways, 4 % Deb.	100	4	4	89 — 91	..	4 7 11
London United Trams, 4 % Deb.	100	4	4	63 — 67	..	5 19 5
Metropolitan Railway Consol.	100	1⅝	1⅝	42½ — 43	..	3 15 7
Do. Surplus Lands	100	2⅜	2⅜†	63 — 65	..	4 4 7
Do. 3½ % Deb.	100	3½	3½	87 — 89	..	3 18 7
Do. 3½ % Pref.	100	3½	3½	82 — 84	..	4 3 4
Do. 3½ % Con. Pref.	100	3½	3½	80 — 82 xd	..	4 5 4
Metropolitan District Ord.	100	Nil	..	29⅜ — 30½	— ½	Nil
Do. 6 % Deb.	100	6	6	138 —141	..	4 5 1
Do. 4 % Deb.	100	4	4	93 — 95	..	4 4 3
Do. 4 % Prior Lien	100	4	4	97 — 99	..	4 0 10
Do. 4½ % First Pref.	100	4½	4½	86 — 89 xd	..	5 1 2
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	91 — 94	—2	4 15 9
Do. 5 % Deb.	100	5	5	89 — 92	—1	5 8 6
Potteries, Ord.	1	3½	..	3/4 — 1	..	..
Do. 5 % Pref.	1	5	5	1⅛ — 1¼	..	7 12 8
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 3 6
South Metro. Trams, 6 % Pref.	1	6	6†	1/2 — 9/16	..	8 0 0
Do. 4 % Deb.	100	4	4	66 — 70	..	5 14 4
Underground Elec. Railways	10	..	..	3⅛ — 3⅜	+ ⅛	Nil
Do. "A"	1/-	..	..	3/16 — 7/16	..	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	112 —114	—1	5 5 3
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 0
Do. 6 % Income	100	6	6	89 — 90	—1	6 13 4
Yorkshire (West Riding), Ord.	5	Nil	..	1/2 — 9/16	..	Nil
Do. 6 % Pref.	5	3	4	3½ — 4½	..	4 11 5
Do. 4½ % Deb.	100	4½	4½	80 — 85	..	5 6 0

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5½	5½	4½ — 5	..	5 8 7
Do. 2nd Pref.	5	5½	5½	4½ — 4⅝	..	6 0 7
Do. 4 % Deb.	100	4	4	92½ — 94½	— ½	4 4 8
Do. 4½ % Deb.	100	4½	4½	97 —100	..	4 10 0
Do 5 % Deb.	100	5	5	96½ — 98½	..	5 1 6
Auckland Trams, 5 % Deb.	100	5	5	103 —106	..	4 14 3
Bombay Elec. S. & Trams, Pref.	10	6	6	10⅜ — 11⅜	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94½ — 96½	..	4 13 3
Do. 5 % 2nd Deb.	100	5	5	98 —100	..	5 0 0
Brazilian Traction, Light and Power	$100	6	6†	86 — 88	—2½	6 16 4
Brisbane Trams Invt., Ord.	5	8	8	7⅞ — 8⅛	..	4 18 6
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	98 —101	..	4 9 1
B. Columbia Elec. Rly., Def.	100	8	8†	113 —117	—6	6 16 9
Do. Pref. Ord.	100	6	6	105 —109	—1	5 10 1
Do. 5 % Pref.	100	5	5	101 —104	—2	4 16 2
Do. 4½ % 1st Mort. Deb.	40	4½	4½	98 —101	..	4 9 1
Do. 4½ % Vancouver Deb.	100	4½	4½	94 — 98	..	4 12 0
Do. 4½ % Con. Deb.	100	4½	4½	95 — 98	..	4 6 9
Calcutta Trams, Ord.	5	7⅛	5†	6½ — 6⅝	..	5 11 1
Do. 5 % Pref.	5	5	5	5 — 5⅛	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	96 — 99	..	4 11 0
Cape Electric Trams	1	5	5	3/8 — 7/16	..	6 13 4
City Buenos Aires Trams (1904)	5	5	5	5⅛ — 5⅜ xd	..	4 10 11
Do. 4 % Deb.	100	4	4	91 — 96	..	4 8 4
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	89 — 93	..	5 7 8
Havana Elec. Rly., 5 % Bonds	$1000	5	5	93½ — 97½	..	5 2 6
Kalgoorlie Elec. Trams	1	Nil	..	0 — 1/16	..	Nil
Do. 5% A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6% B Deb.	100	3	..	10 — 20	..	Nil

La Plata Elec. Trams, Ord.	1	..	..	1/16 — 1/8	..	..
Do. Pref.	1	4½d.	6	1/2 — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	6	6†	1⅛ — 1⅜	..	4 7 3
Do. 6 % Pref.	1	6	6	1⅜ — 1⅝	..	5 1 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr., 6% Cum. Pref.	5	6	6	5 — 5⅜	..	5 11 7
,, Elec. Tr. (1904), Deb.	100	5	5	101 —103	..	4 17 0
Manaos Trams & Lt., 1st Deb.	100	5	5	79 — 82	..	6 2 0
Manila Elec. R. and Ltg., Bonds	$1000	5	5	98 —100	..	5 0 0
Mexico Trams Com	$100	7	7	70 — 73	—1	..
Do. Gen. Con. 5 % Bonds	..	5	5	80 — 84 xd	+1½	5 19 1
Do. 6 % Bonds	100	6	6	81 — 85	..	7 1 2
Para Elec. Rlys. & Lt., Ord.	5	10	10†	4½ — 5⅜	..	9 6 0
Do. 6 % Pref.	5	6	6	4½ — 4⅝	— ⅛	6 6 4
Do. 5 % 1st Deb.	100	5	5	93 — 95	..	5 5 3
Rangoon El. Tr. & Sup., Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	95 — 97	..	4 12 9
Rio de Janeiro Trams, 1st Mort. & 5 % Bonds	..	5	5	97 — 99	—3	5 1 0
Do. 5 % Mort. Bonds	100	5	5	87½ — 90½	—4	5 10 5
Sao Paulo Tram., Lt. and P. & 5 % 1st Deb.	$500	5	5	98 —101	—2	4 19 0
Singapore Trams, 5 % Deb.	100	5	5	88 — 92	..	5 8 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95½ — 97½	—1	5 2 7
Un. Elec. Trams Monte Video	5	7	7	4⅜ — 5½	..	6 16 7
Do. 6 % Pref.	5	6	6	4⅜ — 5½	..	5 14 3
Do. 5 % 1st Deb.	100	5	5	95 — 98	+1	5 2 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	95 — 97	..	4 12 9

ELECTRICITY SUPPLY AND POWER COMPANIES.—HOME.

Bournemouth & Poole, Ord.	10	6	7	10 — 11	+ ½	6 7 4
Do. 4½ % Pref.	10	4½	4½	8½ — 9½	..	4 14 9
Do. Second 6 % Pref.	10	6	6	10 — 10½	..	5 11 7
Do. 4½ % Deb. Stock	Stock	4½	4½	94 — 97	+1	4 12 9
Brompton & Kensington, Ord.	5	10	10†	9 — 9¾	— ⅛	5 4 0
Do. 7 % Cum. Pref.	5	7	7	8⅝ — 9⅛	..	3 16 9
Central Electric Supply, 4 % Guar. Deb.	100	4	4	91 — 94	+1	4 5 1
Charing Cross, West End & City	5	5	6	4⅜ — 5⅛	..	5 14 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4⅝	..	4 12 4
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅞ — 4⅜	— ⅛	5 0 0
Do. Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Chelsea, Ord.	5	5	5	4⅞ — 5⅜	..	4 13 0
Do. 4½ % Deb.	Stock	4½	4½	97 - 100	..	4 10 0
City of London, Ord.	10	9	10	18 — 19	..	5 5 3
Do. 6 % Cum. Pref.	10	6	6	13 — 14	..	4 5 9
Do. 5 % Deb.	Stock	5	5	116 —120	..	4 7 4
Do. 4½ % Second Deb.	100	4½	4½	100 —103	+1	4 8 1
County of London, Ord.	10	6	7	12½ — 13	..	5 7 8
Do. 6 % Pref.	10	6	6	11½ — 12½	+ ½	4 18 0
Do. 4½ % Deb.	Stock	4½	4½	102 —105	+1	4 5 9
Do. 4½ % Second Deb.	Stock	4½	4½	100 —103	..	4 7 5
Edmundson's, Ord.	£8	..	..	3/8 — 7/8	..	Nil
Do. 6 % Cum. Pref.	5	6	6	3¾ — 4½	+ ⅛	7 1 2
Do. 6 % Non-Cum. Pref.	5	..	..	1⅜ — 2	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	6	6	4¾ — 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4⅜ — 4⅝	..	5 2 7
Do. 4½ % First Deb.	100	4½	4½	93 — 95	+1	4 14 9

Hove	5	8	8†	8¾ — 9½	..	4 17 3
Kensington & Knightsbridge, Ord.	5	8	9	7⅜ — 8 xd	..	5 12 6
Do 4 % Deb.	Stock	4	4	90 — 92	..	4 7 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	76 — 80	..	5 12 0
London Electric, Ord.	3	2½	3	1½ — 2	..	4 10 0
Do. 6 % Pref.	5	6	6	5 — 5⅜	..	5 11 7
Do. 4 % First Mort. Deb.	Stock	4	4	91 — 94	+1	4 5 1
Metropolitan	5	4½	4½	3⅜ — 4⅛	..	5 9 1
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 5	..	4 10 0
Do. 4½ % First Mort. Deb.	Stock	4½	4½	97 —100	..	4 10 0
Do. 3½ % Mort. Deb.	Stock	3½	3½	83 — 86	..	4 1 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	100 —103	..	4 17 1
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9⅞ — 10½	..	5 14 3
Oxford	5	7	7†	6 — 6½	..	5 7 8
St. James' and Pall Mall, Ord.	5	10	12	9½ — 10 xd	..	6 0 0
Do. 7 % Pref	5	7	7	6½ — 7 xd	..	5 0 0
Do. 3½ % Deb.	100	3½	3½	82 — 85	..	4 2 4
South London, Ord.	4	5½	5½	3 — 3⅜	..	6 10 4
Do. 5 % First Mort. Deb.	100	5	5	98 —101	..	4 19 0
South Metropolitan, 7 % Pref.	1	7	7	1⅛ — 1⅛	+ 1/16	5 12 0
Do. 4½ % First Deb. Stock	100	4½	4½	97 — 100	..	4 10 0
Urban, Ord.	£8	Nil	..	3/8 — 1/2	..	..
Do. 5 % Cum Pref.	5	3†	..	2⅜ — 2½	..	4 12 0
Do. 4½ % First Mort. Deb.	100	4½	4½	86 — 89	..	5 1 3
Westminster, Ord.	5	10	10	8½ — 9	— ⅛	5 11
Do. 4½ % Cum Pref.	5	4½	4½	5 1/16 — 5 3/16	..	4 4

* Unless otherwise stated, all shares are fully paid. † Interim Dividend. ‡ 8s. Cash and 2% in Funded Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICITY SUPPLY AND POWER—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for		Closing Quotations March 10th.	Rise + or Fall —	Present Yield p.c.
Adelaide, 6 % Pref.	£5	6	6	5 — 5½	..	£ s. d. 5 14 3
Calcutta, Ord.	£5	8½	6†	7⅞ — 8	..	5 6 8
Do. 5 % Pref.	£5	5	5	5⅛ — 5⅜	+1/16	4 18 0
Calgary Power, 1st Mort. Bds.	100	5	5	90 — 92	..	5 8 8
Canadian Gen. El. Com.	$100	7	8	113 —117	..	6 16 9
Do. 7 % Pref.	$100	7	7	123 —128	..	5 9 5
Cordoba Lt., Power and T., Ord.	£1	5	..	7/16 — 1/2	..	7 13 0
Do. 5 % Deb.	100	5	5	90 — 93	..	5 7 6
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	88 — 90	..	6 13 4
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	91 — 94	..	5 6 5
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	93 — 95	..	5 5 3
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	3/32 — 5/32	..	Nil
Do. 6 % Pref.	£1	6	6†	9/32 — 5/16	..	10 11 10
Kaministiquia Power, 5 % G. Bs.	$500	5	5	102 —104	..	4 16 2
Madras, Ord.	£5	Nil	..	1⅛ — 1⅜	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	103½ —106½	+ ½	4 14 0
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	67 — 72	+2	6 19 0
Mexican Lt. & Power, Common	$100	4	4†	41 — 44	—1	..
Do. 7 % Cum. Pref.	$100	7	7	79 — 84	..	8 6 8
Do. 5 % 1st Mort. Gold Bds.	..	5	5	80 — 84	+3	5 19 1
Do. 5 % 2nd Mort. Bonds	100	5	5	65 — 69	+1	7 4 11
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	* 100	1919. 5	191 5	54 — 59	..	£ s. d. ..
Montreal, Lt., H. and Power	$100	9	10†	280 —285	—3	4 5 0
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5a	5a	10 — 20	..	..
River Plate, Ord.	Stock	10	..	235 —245	+10	4 1 8
Do. 6 % Non-Cum. Pref.	Do.	6	6	103 —108	..	b 11 1
Do. 5 % Deb. Stock	Do.	5	5	101 —103	..	4 17 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	102 —104	..	4 6 7
Shawinigan Water, Capital	$100	5½	6†	142 —146	—2	4 2 1
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	+1	4 11 7
Do. 4½ % Per. Deb.	Stock	4½	4½	100 —102	+1½	4 8 8
Toronto Power, 4½ % Deb.	Do.	4½	4½	96 — 99	..	4 11 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	88 — 90	..	5 11 1
Victoria Falls Power, Pref.	1	6	6	33/32 — 35/32	..	7 13 4
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	100 —102 xd	..	5 17 8

MANUFACTURING COMPANIES.

Aron, Ord.	£1	7	..	1⅛ — 1⅜	..	8 12 4
Do. 6 % Pref.	£1	6	6	1/32 — 1/16	..	6 17 2
Babcock & Wilcox	£1	16	14†	3¼ — 3½	..	5 18 6
Do. Pref.	£1	6	6	1⅞ — 1 1/16	..	4 8 6
British Aluminium, Ord.	£1	..	..	1⅛ — 1⅜	+1/32	..
Do. 6 % Cum. Pref.	£1	6	6	1/32 — 1/16	..	6 8 0
Do. 5 % Prior Liens Debs.	100	5	5	96 — 99	..	5 1 0
Do. Deb. Stk.	100	5	5	88 — 93	..	5 7 6
B.I. & Helsby Cables	£5	10	13	9½ — 10⅛	..	4 19 1
Do. Pref.	£5	6	6	5⅝ — 6⅛	..	4 14 1
Do. Deb.	100	4½	4½	102 —105	..	4 5 9
British Thomson-Houston, Deb.	100	4½	4½	92 — 94	+1½	4 15 9
British Westinghouse, Pref.	£2	Nil	..	1 1/16 — 1 1/16	..	Nil
Do. Deb.	100	4	4	68 — 71	..	5 12 8
Do. 6 % Prior Lien	100	6	6	102 —105	..	5 14 6
Browett, Lindley, Ord.	£1	..	..	2/- —3/-	..	Nil
Do. Pref.	£1	..	..	8/- —8/6	..	Nil
Brush, 7 % Pref.	£2	Nil	..	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	80 — 85	..	5 17 8
Do. 4½ % Deb.	100	4½	4½	39 — 43	+2	10 9 6
Do. 4½ % Second Deb.	100	4½	4½	23 — 27	..	16 18 4
Callender's Cable	£5	15	5†	11¼ — 12½	..	6 2 4
Do. Pref.	£5	5	5	4 15/16 — 5 1/16	..	4 16 5
Do. Deb.	100	4½	4½	97 —100	..	4 10 0
Castner-Kellner	£1	20	22½	22⅛ — 22⅝	—3/8	..
Do. Deb.	100	4½	4½	103 —106	..	4 5 1
Crompton & Co., Deb.	100	5	5	83 — 85	..	5 17 8
Dick, Kerr	£1	Nil	..	1/16 — 3/16	..	..
Do. Pref.	£1	6	6	3/16 — 5/16	..	7 2 2
Edison & Swan, A, £2 paid	£5	Nil	..	1/16 — 3/16	..	Nil
Do. fully paid	£5	Nil	..	1 — 1⅛	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Second Deb.	100	5	5	63 — 68	..	7 7 1
Electric Construction	£1	5	..	17/32 — 21/32	—1/32	7 12 6
Do. Pref.	£1	7	7	1 1/16 — 1 1/8	..	6 11 7
Greenwood & Batley, Pref.	£1	7	7	6⅞ — 7⅛	..	9 13 2
Do. Deb.	100	5	5	92 — 94	..	5 6 5
General Electric, 6 % Pref.	£1	6	6	10½ — 10⅝	..	5 14 3
Do. Deb.	100	4	4	86 — 90	..	4 9 0
Henley's, Ord.	£5	15	20	14 — 15	..	6 13 4
Do. Pref.	£5	4½	4½	4⅞ — 5⅛	..	4 7 10
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
India-Rubber, G. & T.	£1	10	7½	10½ — 11½	— ½	6 10 5
Do. Pref.	£1	10	5	8½ — 9½	..	5 5 3
Telegraph Construction	£2	20	20	39½ — 41½	..	5 15 7
Do. Deb.	100	4	4	98 —100	..	4 0 0
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	4	65 — 69	..	5 16 0
Do. B 4 % Cum. Pref.	100	..	..	50 — 55	..	..

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	£10	4½	4½	6¼ — 6⅝	..	6 18 4
Do. 5 % Deb. Red.	Stock	5	5	94 — 97	..	5 3 0
American Telep. & Teleg., Cap.	$100	8	8	123 —126	..	6 7 0
Do. Collat. Trust	$1000	4	4	91 — 94	—1	4 5 3
Anglo-American Telegraph	Stock	3	3	64 — 67	—1	4 9 7
Do. 6 % Pref.	Do.	6	6	108½ —109½	— ½	5 9 4
Do. Def.	Do.	30/-	30/-	23½ — 24	— ⅛	6 5 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104 xd	..	4 16 2
Chili Telephone	£5	8	..	7⅜ — 7⅝	..	5 5 0
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	81½ — 83½	..	4 16 0
Cuba Telegraph	£10	6	6†	8⅞ — 9⅜	..	6 3 1
Do. 10 % Pref.	£10	10	10	15⅞ — 16⅜	..	5 19 5
Direct Spanish Telegraph, Ord.	£5	4	4	3¾ — 4	..	5 0 0
Do. 10 % Cum. Pref.	£5	10	..	7½ — 8	..	6 5 0
Direct United States Cable	£10	4	4†	6⅞ — 7⅛	..	5 10 4
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	97 — 99	..	4 10 10
Eastern Telegraph, Ord. Stock	Stock	7	7	183 —186	..	5 3 0
Do. 8½ % Pref. Stock	Do.	8½	8½	78 — 80	..	4 7 6
Do. 4 % Mort. Deb.	Do.	4	4	95 — 97	..	4 2 4
Eastern Extension	£10	7	7	12⅜ — 12⅞	..	5 8 9
Do. 4 % Deb.	Stock	4	4	94 — 96	..	4 3 4
Globe Telegraph and Trust	£10	6	6†	11⅜ — 11⅞	..	5 1 1
Do. 6 % Pref.	£10	6	6	12⅜ — 13	..	4 12 4
Great Northern Telegraph	£10	20	5†	32½ — 34½	..	5 16 0
Indo-European Telegraph	£5	13	5†	58 — 60	..	5 8 4
Mackay Companies Common	$100	5	5	86 — 90	..	5 11 1
Do. 4 % Cum. Pref.	$100	4	4	70 — 73	..	5 9 7
Marconi's Wireless Telegraph	£1	20	20	3⅜ — 3⅝	+ 1/16	5 6 8
Do. 7 % Cum. Partic. Pref.	£1	17	..	3 1/16 — 3 3/16	+1/16	5 6 8
Monte Video Telephone, Ord.	£1	6	6	1⅛ — 1⅜	..	6 8 0
Do. 5 % Pref.	£1	5	5	1 — 1⅛	..	5 14 8
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	99½ —100½	— ½	4 9 0
Oriental Telep. and Elec.	£1	10	10†	2 — 2⅛	+1/16	4 9 0
Do. 6 % Cum. Pref.	£1	6	6	1⅛ — 1⅜	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	87½ — 89½	..	4 9 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 —100	..	4 0 0
Reuter's	£10	10	10†	8½ — 9½	..	10 16 2
Submarine Cables Trust	Cert.	6	6	126 —129	..	4 13 0
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	96½ — 98½	..	4 11 5
United River Plate Telephone	£5	8	6†	6⅜ — 6⅞	..	5 16 5
Do. 5 % Cum. Pref.	£5	5	5	5⅛ — 5⅜	..	4 9 0
West Coast of America	£2½	2½	..	1 3/16 — 1 5/16	..	4 8 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	£10	1½	1½	2⅞ — 2 1/16	..	4 13 0
Do. 6 % Cum. 1st Pref.	£10	6	6	9½ — 10⅛	..	5 17 0
Do. 6 % Cum. 2nd Pref.	£10	6	6	9 — 9½	..	6 6 4
Do. 5 % Debs.	100	5	5	97 — 99	..	5 1 0
Western Telegraph, Ltd.	£10	7½	7	13⅜ — 13⅝	..	5 2 8
Do. 4 % Debs.	Stock	4	4	95 — 97	..	4 2 8
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	96 — 98	..	4 11 1

* Unless otherwise stated all shares are fully paid. † Interim dividend. *a* Paid in deferred interest warrants

Bank rate of Discount 3 per cent., January 29th, 1914.

The E.T.B.I. — Subscribers are reminded that the annual meeting of the Electrical Trades Benevolent Institution will be held at the Institution of Electrical Engineers, on Wednesday, March 18th, at 2.30 p.m. The report of the Committee and the accounts for the year will be received and auditors re-elected. The following members of the Committee of Management are eligible for re-election at the meeting:—Messrs. W. B. Esson, E. Garcke, T. E. Gatehouse, C. E. Hunter, C. Koettgen, W. Schmahl, A. A. C. Swinton, L. Thurnauer and R. J. Wallis-Jones.

New Association.—The Association of Bristol Electrical Engineers and Contractors has been formed, and has been joined by many influential members of the electrical trade in the city. The objects of the Association are the mutual support and protection of its members. The secretary is Mr. Burkitt, of Messrs. Baxter and Impey, 10, Orchard Street, St. Augustine's, who will be glad to give any information, and Mr. Buchanan, of Messrs. Buchanan and Curwen, Baldwin Street, has been appointed chairman for the current year.

THE WET FILTRATION OF COOLING AIR FOR ELECTRICAL MACHINERY.

By D. A. HACKETT, A.R.C.Sc., A.M.I.E.E.

The application of air, cleaned by what is now generally known as wet filtration, to the cooling of electrical machinery is a comparatively recent innovation, and the installations of this type are as yet few in number. Owing to the rapidly increasing number of turbine-driven generators requiring large and constant volumes of ventilating air, central station engineers are much interested in the method, and are discussing its possibilities. Whilst on the one hand some are favourably disposed towards the new practice, the majority, frankly doubtful, prefer to await the verdict of time in those cases where it is in use before coming to a final decision, and as the time is opportune, this contribution has been written, dealing with a few of the technical aspects, with the view of stimulating the discussion of the practice.

The process of wet filtration may be briefly described as the bringing of the air which is to be cleaned into intimate contact with water in the form of a very finely divided spray. The air may thus be said to be actually washed, for as the particles form nuclei for the formation of drops, they are removed from the air current passing through the apparatus, both by their rate of fall being rendered greater and by the interposition, in the path of the spray-laden air, of specially shaped baffles, from which the air issues clean and without trace of suspended moisture. In addition to the removal of dust particles, the no less objectionable acids, or acid-forming gases, are removed, being absorbed by the water.

The first question that arises is whether it is possible for the water particles to be carried over from the filter by the moving air. It is simply a matter of installing apparatus capable of dealing with the quantity of air required, and there is little doubt that manufacturers of this class of plant would be able to fulfil guarantees of the absolute absence of every trace of suspended moisture in the discharge from the filter.

The air leaving the apparatus is humid, and the greatest amount of discussion in connection with this subject has been devoted to the possibilities attaching to this condition. The insulation resistance of material is reduced by the presence of moisture in it, and considering only the humidity of the filtered air, it might be unsafe, to say the least, to pass it in its practically saturated condition through a machine. This view may be considered from several aspects. It must be remembered that the climate of this country is such, that electrical machines are frequently subjected (more often of course in winter) to atmospheric conditions approximating to 100 per cent. humidity for long periods. This is the case particularly where the machines are of the type requiring forced ventilation, and it is ordinary practice, where the environment is suitable, that is, where the atmosphere remains clean, to pass the air through machines unfiltered, without damage resulting to the insulation. In foggy weather the air is supersaturated and contains particles of moisture, but there is no record of machines having broken down due to the reduction of the insulation resistance at such times, nor is any provision ever made to reduce the quantity of moisture in the event of a fog or unusually humid atmospheric conditions. Finally, machines are insulated for use under ordinary conditions of surrounding air; in practice manufacturers' tests are specified to be made without any special precautions with regard to humidity, and in very many cases it is even specified that the apparatus under consideration should remain in the shops for some days previous to testing subjected to ordinary atmospheric conditions. It would appear then, that the factor of safety of insulation as applied to electrical machines in general would cover such of these as are ventilated by wet-filtered air.

It might be of interest to examine the effect of the passage of the air to and through the machine, on the air itself. Let it be assumed that the filtered air is saturated, that is, that its humidity is 100 per cent. (actually it does not always reach this, the average condition being more nearly represented by 95 per cent.). The air leaving the filter passes to the machine but before coming into contact with the windings, it has to encounter resistance in the form of ducts and bends, and has also to be forced through the machine by some form of fan. In this process energy is expended, the air temperature is raised, and the humidity thereby reduced. It may seem that this effect is slight, but in the first place it requires a comparatively small amount of energy to raise the temperature of a cubic foot of air through one degree (0.575 watts per cubic foot per minute), and for a given moisture content the humidity of a given weight of air decreases rapidly as its temperature rises.

If air at 19.5 degrees C. and 100 per cent. humidity at normal atmospheric pressure, have its temperature raised one and a half degrees, the humidity drops to 90 per cent. If an actual case be taken, and assuming 65 per cent. as an average figure for the efficiency of the external fan supplying air to the machine, calculation shows that the losses in the fan and ducts produce an increase in temperature of about three degrees before the air comes in contact with the windings. The resulting humidity in this case with 100 per cent. leaving the filter is 79 per cent., which is below the average for winter atmospheric conditions in this climate.

It has also been pointed out that the air around a central station, by reason of the water vapour liberated in various operations, has, as a rule, a large amount of suspended moisture present against which no special precautions are taken.

The effect of the heating of the machine itself must be considered. An examination of the heating curve shows a sharp and immediate rise in temperature after putting on load. This should act in the direction of preventing an undue absorption of moisture by the windings, should the humidity be high. It is also worthy of consideration to note that in a generating station, due to the radiation from steam pipes, engines and generators, the air temperature is higher than the external air, and, as a result, the windings of a machine, when put on load, are already several degrees higher than the cooling air, and therefore initially more likely to resist the condensation of moisture in them. This fact taken in conjunction with the rapid rise in temperature referred to previously, and the increase in temperature due to work done in moving the air, tends towards the reduction of the percentage of humidity, and therefore to the original condition of the air as regards moisture previous to filtration.

It is claimed that the air is cooled as well as cleaned by the process of wet filtration, and as this tends in the direction of a lower maximum temperature, it is desirable to form some idea as to the amount of the reduction in air temperature and the effect of the increased moisture content on the cooling qualities of the air, that is, practically speaking, on its specific heat. If air be taken at atmospheric conditions of temperature, pressure and humidity, and caused to take up water vapour in such an apparatus as the filter under discussion, the air will be cooled owing to the heat absorbed in the evaporation of the water. It is correct to assume that the quantity of heat lost by the air is equal to that absorbed by the water during evaporation. From this consideration the reduction in temperature due to air taking up various quantities of moisture can be calculated, and from hygrometric charts it is a simple matter to obtain the amount of vapour present at the assumed condition

(for air leaving the filter) of 100 per cent. humidity at any temperature. The temperature to which air at any other temperature and humidity falls when saturated in this manner, can be obtained with reasonable accuracy. The air temperature will not be reduced quite to the wet-bulb temperature corresponding to the atmospheric conditions, but to a temperature slightly higher, due to the increase of the moisture content consequent on the passage through the filter. A concrete example will make evident the extent of the cooling effect.

If air at 13.9 degrees C. and 81 per cent. humidity, corresponding to average summer conditions, be treated in a wet filter so that it emerges at 100 per cent. humidity, the resulting air temperature is 12 degrees C. The wet-bulb temperature corresponding to the original conditions is 11.75 degrees C. The cooling effect is due mainly to the latent heat absorbed by the water in evaporating, and it does not seem feasible except possibly in special cases still further to reduce the temperature materially by the addition of refrigerating plant, cooling the water supplying the sprays in the filter. It is doubtful if much advantage can be gained in this way unless some highly efficient, compact refrigerator capable of operating without supervision, can be found.

With regard to alteration in cooling qualities, an investigation of the change in specific heat and density, for the average conditions given, shows a 0.2 per cent. increase in specific heat, and an increase in density of, approximately, the same amount, so that there is a slight advantage in these respects also.

Summing up, it would seem that there is a fairly good case for the installation of wet air-filtration apparatus from the purely technical aspect. It undoubtedly produces clean air, the advantages of which it is not necessary to dwell upon, and whilst the reduction in temperature may not, generally, be great, the air is certainly cooler after filtration. With regard to the danger of breakdown, it would be of interest if some experiments were carried out under actual conditions to discover if any material alteration in insulation resistance does occur, and in this connection experience might be gained at first on low-voltage machines, where the risk of breakdown is less. It is outside the scope of this article to discuss the costs of such installations, the different types, or comparative figures for upkeep, but it might be urged that the publication of such particulars would be of the greatest interest to electrical engineers in general at the present time.

HOW TO OBTAIN SINGLE-PHASE CURRENT FROM A THREE-PHASE SUPPLY.

By "SNICK."

This article is intended briefly to describe how, by suitably connecting static transformers to a three-phase system, it is possible to obtain a single-phase circuit, meaning by the latter one monophase circuit, and not three separate two-wire circuits, the phase displacement between each pair being 120°.

In nearly all cases single-phase current is only required for lighting, whereas for power purposes it is needless to wastefully convert the existing three-phase system, which so admirably lends itself to power applications. Of course, if a three-phase system is available, the lighting load may be split up into three portions, each being supplied from one phase of the secondary. This, to a certain extent, needlessly complicates the wiring, and if a single-phase system consisting of two wires only could be obtained, a much simpler installation would result. It will be seen later, however, that such a transformation gives rise to a considerable out-of-balance on the primary side, which may or may not be of importance to the source of supply, depending, of course, upon the size of the plant supplying the system. Three ways of connecting up transformers to give single-phase on the secondary are described herein, the first method using two single-phase transformers, the second one transformer, and the third method three transformers. In the first, two transformers are coupled together, with the winding of one reversed, as shown in fig. 1. The phase relations of the currents and voltages are shown upon the diagram in fig. 2.

Starting from the generator, the voltages of the three phases, N P, N Q, and N R are given by—

$$V_1 = V_2 = V_3.$$

The voltage across the primary winding of transformer 1 is the vectorial sum of V_1 and V_2, *i.e.*, P Q; similarly, the voltage across the primary of transformer 2 is P R. The

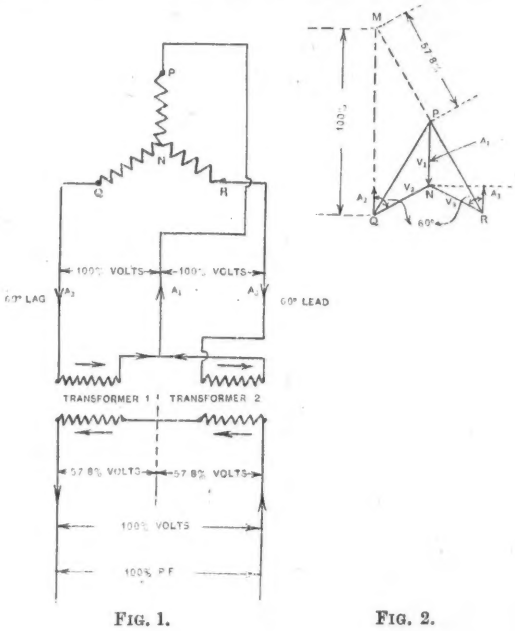


Fig. 1.

Fig. 2.

voltage across the secondary of transformer 1 will have the phase of P Q, and that of the secondary of transformer 2 will be in phase with P R reversed (as one winding is reversed). The total voltage of the secondary circuit will, therefore, be in phase with the vectorial sum of P Q and P M, viz., M Q. As the secondary load is non-inductive the secondary current, and consequently the primary currents, are in phase with M Q. It will be seen, therefore, that in the wire leading from Q the current lags V_2 by 60° (*i.e.*, a power factor of 50 per cent.) whereas in the line leading from R the current leads V_3 by 60°, but as $A_1 = A_3$, A_3, the current in the middle wire leading from P, will be in phase with V_1; thus considerable out-of-balance results on the primary side, and consequently the advisability of installing such a system as the one in question depends on the relative sizes of the lighting load and the power station capacity. On referring to fig. 1 and fig. 2 it will be seen

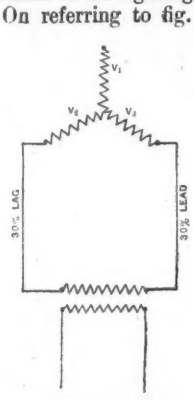


Fig. 3.

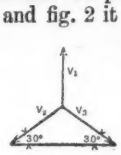


Fig. 4.

that the transformer unit must have a total capacity of 115·6 per cent. of the lighting load (because the voltage across the secondary of each transformer is 57·8 per cent. of the total secondary voltage, as will be seen by comparing the

lengths of P M and M Q). The power factor of the unit will therefore be 100/115·6 = 0·865.

Another method of obtaining single-phase current is illustrated in fig. 3, where one single-phase transformer only is used. Again, considerable out-of-balance results, the currents differing in phase from the generator phase voltages by 30°, leading in one wire and lagging in the other wire, as is shown on the vector diagram fig. 4.

This method is, of course, somewhat cheaper than that first described, as only one transformer is used, and the

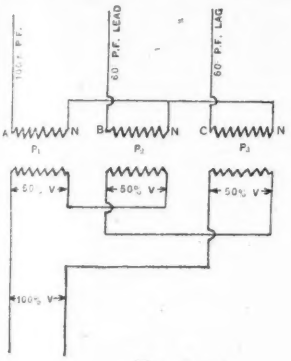


FIG. 5.

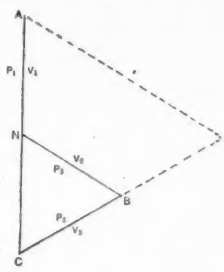


FIG. 6.

capacity of the set is 100 per cent. of the total output, as against the capacity of 115·2 per cent. as described in the first case.

The third method using three single-phase transformers, or one three-phase instrument is sometimes used, the connections being shown in fig. 5, the corresponding vector diagram to which is fig. 6. In the latter A N, B N and B C represent the voltages of the three phases P_1, P_2 and P_3 respectively. The vectorial sum of these, *i.e.*, A C will represent the voltage of the secondary circuit, and it is at once seen that this is twice the voltage across any one of the secondary windings. The secondary current, and consequently the primary load currents, will therefore be in phase with A C. The current in the wire leading from A will thus be in phase with V_1; that in wire leading from C will lag 60° behind the phase voltage V_2; whilst that in the wire leading from B will lead the phase voltage V_3 by 60°. The output of the transforming set will consequently be 150 per cent. of the total output, giving a total power factor of $\frac{100}{150}$ = 66·6 per cent. Even if the phase P_2 were reversed, the same degree of out-of-balance would result, the current in the wire leading from B being in phase with V_3, and the other two phases having currents leading and lagging by 60°, as already described. This method is more complicated than those already described, as three transformers are used, and the total power factor is considerably less.

It will be seen that with the methods described, although single-phase is obtained on the secondary side, the system is out of balance on the primary side. Of course, if the lighting load is small compared to the capacity of the generating plant, this out-of-balance may be unimportant, and the method of connecting may be permissible, although in cases where such out-of-balance would materially affect the supply system, some method, such as the one using three

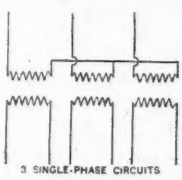


FIG. 7.

separate transformers giving three separate two-wire single-phase circuits, would have to be adopted, such an arrangement being shown in fig. 7.

An alternative to the latter system would be to use the Scott method of connecting, when two single-phase two-wire circuits would be the result, the phase difference between them being 90°.

REACTANCE AND REACTANCE COILS IN POWER CIRCUITS.

BY E. P. HOLLIS, A.M.I.E.E.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS, *at Newcastle-upon-Tyne, January*, 1914.)

UNTIL recently engineers endeavoured to avoid reactance in all its forms; but it is now realised that reactance has virtues hitherto unsuspected, which if turned to account confer important benefits on electrical power supply systems.

One of the problems that beset engineers concerned with the operation of extensive power supply systems is that of limiting the excessive current that may momentarily flow in the case of a short circuit. In the case of a generator in which no special care has been taken to ensure a high self-induction, the current rises at the first instant of short-circuit to something like 30 times the full-load current.

The first rush of current is controlled by little more than the self-induction of the armature and the resistance of the circuit, which act practically instantaneously in stemming the rush of current.

Recent developments in design have tended to reduce the self-induction of the armature, with the result that in a modern turbo-generator, unless very special endeavours are made, the leakage reactance (*i.e.*, that due to self-induction only) represents only from 10 to 15 per cent. of the synchronous reactance measured on the short-circuit test. Nowadays, however, designers have paid special attention to increasing the self-induction of the armature, and by various devices have increased the ratio between the armature inductance and the whole inductance.

Taking a power-supply system in which generating plant to the amount of about 50,000 KW. is in use daily, a short-circuit between phases near the power station might mean a current of 120,000 amperes, which of itself would exert sufficient mechanical force to cause serious damage to cables, bus-bars, and connections. On the switches, also, its action would not be negligible. With the switch closed the current is 120,000 amperes, and the voltage negligible; and with the switch open the current is zero and the voltage is the full phase value; but between these positions there is a moment when the amount of power is exceedingly large. It can be expressed in kilovolt-amperes for one phase by half the product of the maximum current and the maximum kilovolts, which comes to over half a million kilovolt-amperes.

It appears, then, that a good case can be made out for imposing some limits to the amount of short-circuit current, and in many instances reactance coils are being successfully employed for this purpose.

Apart from their ability to relieve the power station of the shocks and stresses due to short-circuits, reactance coils largely promote the stability of a system, and it will probably happen that when the time comes for the operation in parallel of distant large power stations, reactance coils will become essential, assisting the synchronous machinery at a distance—whether generating or motoring plant—at critical moments. Hitherto the reactance of the transformers and transmission lines only has been available for this purpose.

For some years attempts have been made to promote continuity of supply in power stations by adopting the so-called "unit" system of running. Unless the expenditure be very great the generators must run in parallel, either through the bus-bars or the network, and all the troubles incidental to a breakdown on the bus-bar side of a grouped station are repeated in the case of a system operated on the unit principle. Power-limiting reactance coils are valuable not only when inserted in the phase leads of the generator, but also between the bus-bar sections.

Reactance coils inserted in the bus-bars limit the amount of power which a group of machines can supply on short-circuit to a feeder the normal load of which is being supplied in part by another group of generators. The station bus-bars would be "ring" connected and a set of reactance coils would be placed between each group of machines. Thus the perfect unit system can be more nearly attained by using reactance coils. Circumstances peculiar to every case fix the exact value of the reactance, for which 20 per cent.* of the generator capacity of each section would be an approximate figure.

Reactance coils in feeder circuits naturally follow for limiting the power on short-circuit in underground and short overhead lines. In the case of interconnecting mains between power stations, reactance is also desirable to promote parallel running, especially where the resistance of the feeders is large.

The heavy duties which the modern oil circuit-breaker is called upon to perform present severer difficulties as the size of the generating unit increases. For rupturing heavy currents a "resistance" circuit-breaker was developed; reactance, however, is preferable to resistance. The reactance coils are so connected that they may be placed in series with the line, the load, and the main contacts; but with the circuit-breaker closed they are short-circuited by auxiliary contacts. These contacts are the first to open, and thus connect the coils in series with the line and reduce the current before the main contacts separate. These main contacts then break the load current at its reduced value.

In several instances abroad operating engineers, by inserting

* The value of the reactance coil is most conveniently referred to in terms of the percentage drop of voltage across its terminals with full-load current flowing.

reactance coils between the incoming generator and the bus-bars, have freed themselves from the anxieties of synchronising. These coils have been designed to allow the generator to be switched in when 180° out of phase with the bus-bar voltage without undue stresses being caused.

With the development of the so-called "self-synchronising" synchronous motor, it is not improbable that reactance coils will be employed to limit the rush of current on switching-in, taking the place of more complicated starting devices.

Experimental results at the Fisk Street station, Chicago, clearly indicate that reactance coils do materially reduce the short-circuit current. The conclusion reached as the result of this investigation was that the total leakage reactance should not be less than 15 per cent.

The tests demonstrated that the presence of steam on the turbine in no way affected the results, *i.e.*, the short-circuit energy came from the rotating mass of the machines.

One of the earlier uses to which it was suggested to put reactance coils in alternating-current power circuits was that of limiting the flow of the third-harmonic currents between three-phase star-connected generators. A 10 per cent. reactance inserted in the phase leads renders the third harmonic negligible; and even an 8 per cent. reactance does all that is necessary in this direction.

Increased reactance in a circuit with a lagging power factor naturally adversely affects the regulation; but this is a matter which is not so important as it was some years ago. The development of the automatic regulator offers a solution, and a generator with poor inherent regulation can be made to give a pressure curve comparing favourably with the best that can be obtained from the most carefully-designed good regulating machine. In a sense reactance improves the regulation, since at critical moments in the case of a short-circuit it helps to maintain the voltage when otherwise the pressure would have decreased and the synchronous machinery have fallen out of step.

The problem of protecting a transformer against high-frequency surges is an old one. It has been found that these dischages flowing into the tranformer break like a wave against a breakwater, and expend their energy in the first few turns of the transformer winding, occasionally breaking it down. Reinforcing the insulation of the end turns has been successfully resorted to. An external reactance coil not only would prevent abnormal waves from entering the transformer, but it would retain inside the latter all those oscillatory currents which either arise inside the transformer or come from the line, and are transformed to a higher pressure at the point where the line is connected to the transformer. It would appear, then, that endowing the transformer with high internal reactance would be preferable.

Up to recent years consulting engineers specified transformers with low reactance. Now the position is reversed, and consulting engineers specify high reactance and obtain it. The interior of a transformer is, however, no place for a large amount of reactance.

A small amount of reactance can be secured in a transformer of standard design sufficient for most rotary converter work, and higher reactances up to 25 per cent. are possible by introducing special arrangements, such as the use of magnetic shunts to increase the leakage flux. But it is impossible to design a transformer with magnetic shunts which will maintain its reactance in the case of a heavy short-circuit current. Far too much iron would be necessary in the shunt to carry the very heavy flux, and the regulation at normal loads would be very bad. In the external reactance no iron at all is used, an air core being employed in order to avoid this defect.

Reactance can only be relied on as a current-limiting factor so long as the iron paths which carry the leakage flux remain unsaturated; high internal reactance does not improve the transformer—very often it will mean much greater eddy-current losses. It seems better to obtain any large amount by the aid of external coils, especially when the limiting of the short-circuit current is in mind.

Inductance plays a prominent part in the characteristics of transmission lines. In long lines, the line inductance is coresponsible with the capacity for a large rise in pressure towards the receiving end of the line.

This excess pressure is a cause of anxiety in long lines, for the voltage regulation is bad. On switching-in the line the pressure at the far end rises at least to its no-load value, which may often be 150 per cent. of the generator pressure, but frequently a pressure 200 per cent. of that of the generator may be reached. With varying loads, too, the pressure changes are great at the end of the line and are a considerable source of inconvenience. Shunting capacity can be compensated for by shunted inductance,* and the best palliative would be a uniformly distributed inductance throughout the whole length of the line. The best that financial considerations would permit would be a few reactance coils at intervals along the line.

Apart from voltage regulation the introduction of reactance, series or shunted, may be used to increase the efficiency of the line and the maximum amount of power that can be transmitted.

One of the developments that the future may hold is that of a large electrical network interlinked throughout, and fed at numerous points at which opportunities for cheap power development present themselves. Such a system exists to some extent today on the north-east coast, and there is every likelihood that in other industrial centres this lead may be followed. In such a scheme, under present conditions, variations in pressure throughout the system are unavoidable.

* In telephone work shunted capacity is compensated by series inductance (loading coils).

Proposals have been made for constant-pressure schemes in which, however large and however extensive they may be, the voltage is maintained constant. The theory on which these proposals have been based is that since a leading current flowing through a reactance experiences a rise in pressure, this phenomenon can be utilised to give a constant-potential line by varying the amount of leading current according to the load. This theory premises the inclusion of a considerable reactance—no matter how it may have been obtained—in the line. The source of leading current of adjustable value can only be synchronous condensers, over-excited motor-generators and (but not advisedly) rotary converters situated at various points about the system. Most lines would not possess sufficient reactance, and therefore it would become necessary to add it in the form of series reactance coils.

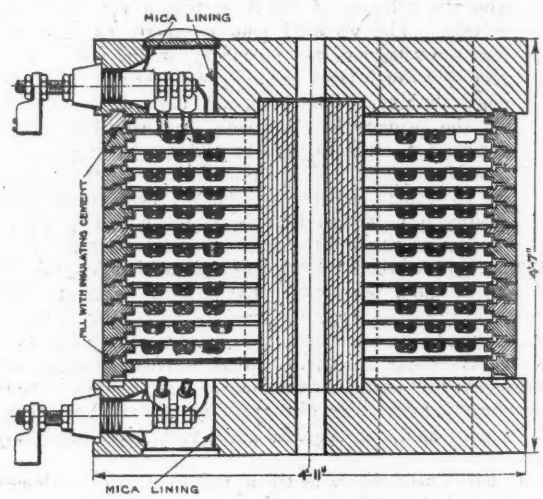
A system designed on these principles would have a number of remarkable operating characteristics. When a short-circuit occurred in any part of the line, in view of the fact that the short-circuit power would be less than the full-load power, there would be no general interference with the system. There would be no diminution of efficiency.

In some instances reactance coils are used to protect the end-turns of high-tension induction motors at the moment of switching on. These coils are often of the ironless pattern, a few turns of copper strip wound in a helix or flat spiral serving the purpose.

The problem of larger adjustable coils is one that will have to be tackled seriously in the future. A continuous-current coil for superposing a continuous flux on an alternating flux might well be used to render the reactance coil adjustable. Without materially affecting the core loss, the continuous current gives the iron a magnetic bias, and the reactance coil takes a higher magnetising current than it would otherwise do.

The construction of current-limiting reactance coils entails a number of difficulties. In addition to the severe mechanical stresses incidental to a short-circuit there are electrical stresses due to transient voltages, and the reactance coils may have to carry the current for many minutes. Iron must be avoided in the construction, and in view of the strong leakage field, all solid metal-work in the coil will be the seat of eddy currents, and may become unduly heated and cause a fire. Steel bolts, for instance, must not be used.

In practice the coil takes several forms. In one, copper cable is wound under tension upon special wood supports which are bolted to a cylindrical concrete core.



Sectional View of a Porcelain-clad Reactance Coil.

Another form of reactance coil is the porcelain-clad coil, the chief characteristics of which are that the pancake instead of the drum winding is adopted. The cable is enclosed in a porcelain case, with the result that the coil is smaller than one with air insulation. The reactances are built up of horizontally-wound spirals (see diagram) supported in recesses formed in the porcelain arms, which radiate from a central core of alberene stone to an outer enclosing well built up of porcelain segments. There are two heavy concrete headers, one at either end, and these are fastened to the wall by a number of mica-insulated brass rods passing through the headers and porcelain segments. The conductors are insulated, and the arrangement of the interior of the coil gives a cellular construction which permits adequate self-ventilation.

A typical coil constructed on this principle was said by the manufacturer to give the following results:—Number of turns, 34; reactance, 4·2 per cent. (20,000 KW., 6,600 volts, 26 cycles); ohmic resistance, 0·00195 ohm; I^2R loss, 6·05 KW.; eddy-current loss, 0·186 KW.; total losses, 6·236 KW. per coil; temperature rise, 33° C.

Discussion.

Mr. P. V. Hunter said that at the commencement of the paper it was stated that recent developments in the design of generators had tended to reduce the self-induction of the armature, but his

experience was that the most recent practice was to increase the self-induction of the armature, and during the last year or two designers had endeavoured to increase the self-induction without sacrificing mechanical rigidity. The use of reactance in bus-bar section switches was proposed in power stations, and there were arguments in favour of their use in that position, but there was an important argument to the contrary, namely, that on an ordinary transmission system the bus-bar sections were also connected together through the transmission system in parallel with the bus-bar section switches. A bus-bar reactance having a substantial difference of pressure across its terminals when loaded, would therefore shunt a somewhat heavy current through those feeders in parallel with it, and if to meet this objection the use of such parallel feeders was avoided, a large network then became an uneconomical aggregation of small networks, and the cost would be prohibitive. The author suggested the use of reactance coils in feeder circuits, but his experience was entirely opposed to their use in these circuits; in fact one of the transmission difficulties in the Newcastle district was the reduction of the effective transmission distance of overhead lines as compared with cables, due to the reactive drop. This necessitated considerable expenditure in regulating apparatus. He was unable to agree that voltage variation was unimportant, as it was a matter of some difficulty to keep the consumers' terminal voltage reasonably constant, without incurring expenditure in special voltage regulating apparatus. He had not found it necessary to use reactances in generators. Generally it would be found convenient to step up to a higher voltage through a transformer, and it was very easy to incorporate a reasonable amount of reactance in transformers without additional expense. As regarded the use of reactance coils to protect transformers, the same purpose was served by specially insulating the end turns of the transformer. To specify transformers with high reactance was not the policy of the firm with which he was connected. High reactance in transformers, in order to reduce the short-circuit current and consequent mechanical damage, was both objectionable and unnecessary in power transformers, as they could be constructed without materially increasing the cost, to withstand short-circuit currents of forty times full load. This corresponded to a full load impedance of 2½ per cent., and a regulation on ordinary power factors of the order of 2 per cent., which might be considered satisfactory. The author's suggestion for obtaining a constant potential transmission system was most interesting, but the amount of costly synchronous plant which would have to be installed would be prohibitive. The author suggested the use of reactance coils to protect the end turns of H.T. induction motors, but he would suggest the use of a transformer, as he did not think that the stator of a motor was the place for a high-tension winding, especially on smaller motors where there was an increased probability of shock and breakdown. The suggestion of the use of a continuous-current coil for superimposing a continuous flux on a reactance, to render the reactance adjustable, was most interesting, but it occurred to him that the alternating current through the reactance coil would have dissimilar shapes for each half of the wave.

MR. R. W. GREGORY hoped that the author would not persuade anyone to fit reactance coils on power station bus-bars; it was an axiom amongst switchgear designers and engineers to keep power station bus-bars as simple as possible, and free from apparatus of any sort.

MR. J. R. ANDREWS pointed out that overhead telephone lines in England were not loaded; over ordinary overhead wires, conversation was possible for a distance of some 1,600 miles, whereas the greatest distance of speech for standard underground cables was some 36 miles.

MR. J. SCHUIL said that reactance coils were largely used in America, and there was no question about their value. The engineer of one of the Washington stations had told him that, owing to short-circuits, they had had one of their generators burnt out twice, resulting in its being laid off for eight months altogether, but since the introduction of inductances they had had no breakdowns on the machines.

MR. J. R. BEARD said that manufacturers could readily build machines with sufficient internal reactance to limit the maximum momentary short-circuit current to less than 12 times the R.M.S. current at normal load, and on large systems there was, in addition to this, the reactance of the step-up transformers. An extensive series of tests made in the Newcastle district had proved that transformers designed on ordinary commercial lines with a regulation of, say, 2 per cent. or 3 per cent. at 0·8 power factor, could be constructed to stand up to a dead short-circuit on the secondary side with full terminal voltage maintained on the primary side. The indiscriminate use of reactance coils on a 20,000-volt system would, for all practical purposes, reduce the effective voltage to the equivalent of, say, 11,000 volts. As it was uneconomical to tap main feeders near the power station, such feeders were usually of considerable length, and thus had sufficient impedance to prevent excessive current flowing into a short circuit at their far end; a breakdown in the feeder itself was not more probable than a breakdown on the reactance coil, and, in any case, the switchgear at the power station would be designed to meet such a contingency. He agreed, however, that reactance coils should be used on short feeders, especially where the power station was large. In this case the drop of pressure in the reactance was of less importance, ordinary sub-station gear could be used, and the consumer could safely use standard commercial switchgear, whereas if no means were taken to limit the short-circuit current, the supply authority would have to install the power-station type of switchgear at the sub-station, and the consumer would also be called upon to install switchgear of special design. With regard to the author's recommendation that reactance coils should be used for sectioning extensive high-tension networks, this might be advantageous in some cases, but, in the case of the local companies, who were operating a large number of waste-heat stations running at practically constant output, the power flowed in different directions at different times, consequently an arrangement of reactance coils to suit one set of conditions would certainly not suit every set of conditions, without the use of extensive and complicated regulating arrangements.

MR. W. BAXTER said that after reading the author's paper, one was led to believe that there was no electrical trouble which inductance coils could not cure, but the fact that these coils were not used to any extent on the local supply systems, which were admittedly the best engineered in the country, indicated that there were other ways of getting over the difficulties mentioned in the paper. He had recently come across a case of two large fan motors at a colliery, which gave continual trouble on a 3,000-volt system due to "potential front," but the trouble was got over entirely by arranging high-resistance nets in the main oil switches, with contacts so designed that the high resistances were momentarily connected in series with the stator winding, and he thought that an arrangement of this sort would be very much cheaper than any type of external reactance, as all that was necessary was to deepen the tanks slightly.

MR. R. C. PHILIPP mentioned the use of choke coils for connecting transformers of different regulation, capacity or voltage in parallel in case of emergency.

MR. C. S. VESEY-BROWN said that his experience led him to use reactance coils wherever possible, because a generator was a very expensive thing to repair in the event of a breakdown.

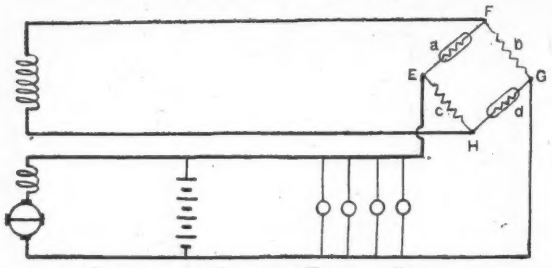
MR. E. P. HOLLIS, in reply, said that it had been suggested that the cost of synchronous machinery would be very great; but transmission lines were very costly, and as their capacity would be much increased by the use of synchronous machines, he estimated that a saving could be shown. With regard to the use of reactances for protecting the end turns of motors, the Birmingham Corporation now insisted upon all large motors on their mains being so protected. These reactances were not large, being only about 14 in. long × 8 in. or 9 in. diameter. It was not very easy to run rotaries in parallel with generators, but by using reactances in series with rotary converters the trouble could be overcome. The cost of reactance coils should really be put down as insurance money, because on large systems a shut-down was very costly, and anything which ensured continuity of supply should not be looked upon as unnecessary expenditure.

ELECTRIC TRAIN LIGHTING.

(*Discussion on paper read by* MR. T. FERGUSON *before the* INSTITUTION OF ELECTRICAL ENGINEERS, MANCHESTER LOCAL SECTION, *on January 27th*, 1914. *For abstract of paper see* ELECTRICAL REVIEW, p. 290.)

DR. E. ROSENBERG remarked that electric lighting was incomparably safer than gas lighting, and the tanks of compressed gas carried underneath coaches did not tend to increase the safety of the travelling public. During a discussion arising from the Aisgill disaster, a prominent person stated that from information he had received, there was not a single electrically-lighted coach on the German or Austrian State Railways. The speaker contested this statement, and said that although the majority of coaches were still lit by gas, there were hundreds of electrically-lit coaches on the railways referred to. The French State Railways had also taken up the electric lighting of coaches very actively since the Melun collision in which gas played such a disastrous part. There was no such thing as a strictly constant-voltage system or constant-current system. The system of Stone and the author, for example, were constant-torque systems, and endeavoured to give a current in inverse proportion to the momentary voltage of the battery. In the so-called constant-voltage systems, the voltage had to rise gradually from approximately 2 volts per cell to the charging voltage, *i.e.*, 2·4 volts per cell. It was to be remembered that regulators were not very accurate appliances. A very interesting constant voltage system designed by Mr. Woodridge, of the Electric Battery Co., of America, was specially distinguished by the omission of any kind of lamp regulator or resistance between battery and lamps. A pressure of 2·25 volts per cell was employed, and it was claimed that this was sufficient to keep the battery well charged and in perfect order. Further, the voltage was so low that the gradual increase in the illumination when the battery voltage rose from rest was not felt uncomfortably by the eye. The arrangement, as shown in the diagram (p. 468), consisted of a generator which was a modification of the Rosenberg machine mentioned in Mather & Platt's system. The field winding was composed of a series winding just strong enough compensate the armature reaction, and a shunt winding taking a small current, connected as one diagonal of a Wheatstone bridge arrangement; *a* and *d* in the figure represented bulbs containing iron wire in rarified hydrogen, and *b* and *c* were ordinary resistances. The remaining diagonal of the bridge was connected in parallel with the battery across the generator terminals. It was well known that iron wire when nearing a dull red heat increased enormously in resistance with a slight increase in temperature, and this feature was employed in the system. If the generator voltage was slightly below its normal value, the current through the bridge would drop slightly below its calibration value and the voltage drops between E and F, and G and

H respectively would be very low, also the exciting voltage for the shunt would be much lower than the battery voltage. A slight rise in the battery voltage, however, would reduce this exciting voltage considerably, even down to zero, consequently the machine would not perceptibly change its voltage whatever increase in speed might occur. The system had been



Woodbridge Constant-Voltage System.

employed very successfully in America. The statement that "with most double-battery systems the efficiency is probably not more than about 5 per cent. to 10 per cent. of the current generated" seemed remarkable, and surely could not refer to systems which provided a definite current, independent of belt slipping and a current graduated in accordance with the momentary lighting load. The dynamo efficiency of 65 per cent. seemed a fair figure, provided it included belt losses in systems which worked without belt slipping. The author described an overcharge preventer: did this apply when lights were on? A long non-stop run might cause the battery to reach "gassing" point, even with lights on, and breaking the field might mean that during the remainder of the journey the battery would have to feed the lamps and become discharged again. This would be a disadvantage as compared with systems where the output could be adjusted by changing the excitation, and where the overcharge preventer could be arranged to reduce the excitation to such a value that the dynamo current equalled the lamp current.

Mr. J. Denham said that an empty train might stand in a station or siding all night with the switches on, and, in his opinion, some over-discharge prevention should be employed.

Mr. F. E. Cooper referred to the gas lighting of trains as a tremendous danger, and associated himself with a previous speaker in forecasting the abolition of gas before very long.

Mr. A. Pope said that one important system used extensively in America and on the Continent, but not referred to in the paper, was the straight storage system. The system had many advantages, especially as applied to trains running to and fro between towns about 12 miles apart. When facilities could be provided for charging at one or each end, small batteries only were needed. A sulphated cell could not be cured by running in service; the only remedy was complete overhaul in the repair shop.

Mr. McKinnon referred to the difference in the care taken of batteries in Germany and Scandinavia as compared with this country. Whilst working conditions here had greatly improved, they were far from ideal. A recent catalogue stated that "attention at very infrequent intervals only is required to see whether, on the whole, the battery is over or under charged." This could only be construed into an invitation not to trouble about the cells very much. In this country the cells were so placed that access could only be obtained after crawling under the coach and removing very numerous bolts and connections and lids, the whole operation having to be carried out in a kneeling position. In Germany the cells were arranged neatly under the body of the coach, and the footboard in front of the compartment was arranged to swing up, giving easy access for inspection. In Denmark axle-driven systems were not in common use, owing to the number of ferries on the main routes, and straight battery lighting was employed. The author stated that any of the constant-current systems could be maintained by comparatively poor class labour, also that traffic conditions demanded that a poor class of labour should be able to maintain the equipment. This was the keynote to the question of battery depreciation. In England rule-of-thumb method, indifferent attention, and quite crude switchgear were the rule, and if anything went wrong, the battery was blamed. In Germany there was splendid organisation and close attention, and if anything went wrong, the mechanic was blamed. Dr. Rosenberg had referred to Mr. Woodbridge's statement that a voltage of 2·25 would maintain a cell in proper condition in train lighting service. One point had apparently been missed here, namely, that the cell should be kept healthy. Once cells were allowed to become sulphated through standing idle or discharged, for long periods, then such a voltage would not restore the cells to a healthy state, and the system would, therefore, probably be a failure under the ordinary conditions on British railways.

Mr. W. Stansfield said that the author, in referring to Mr. Dalziel's system, recommended the replacement of the special magnetic circuit by differential coils in the exciter circuit, using an iron wire resistance with one coil. The speaker had, in conjunction with Mr. Hatt, developed a train lighting system on somewhat similar lines, and obtained some very promising results with experimental machines. In was found that, by connecting the exciter to the main machine at one pole, and connecting the differential coils so that the one with the iron wire resistance was across the main machine, and the coil without the resistance was across the free ends of the main machine and the exciter, almost any characteristic could be obtained from one rising as the speed was raised, through a level voltage line irrespective of speed (within the limit of the speeds allowed for) even to a characteristic in which the voltage actually fell after rising to a maximum. The speaker had also experimented with the special bridge arrangement referred to by Dr. Rosenberg, and obtained very fair results, although not so good as with the differential coil arrangement.

The Author briefly replied.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Combination Ceiling Rose and Switch.

The General Accessories Co., Ltd., of 70, Worship Street, E.C., have brought out a device intended to supersede the key-holder for pendant lamps, in the shape of a ceiling rose containing a switch, from which a chain hangs alongside of the flexible. The interior of the rose is shown in fig. 1, and the complete device in fig. 2. The light is switched on and off by alternate pulls on the

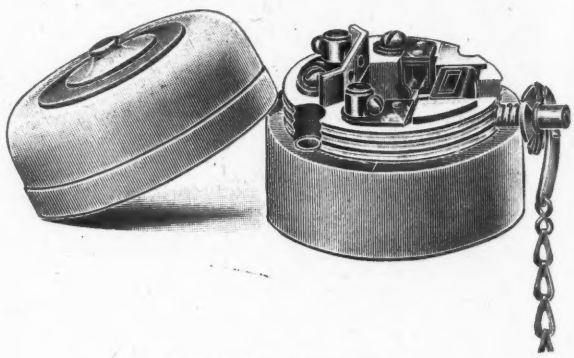


Fig. 1.—Interior of Rose.

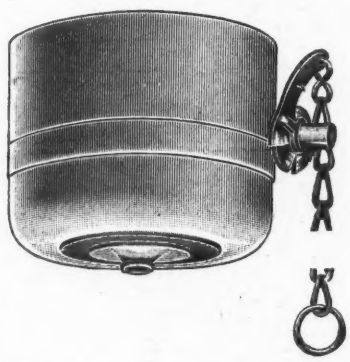


Fig. 2.—Combination Ceiling Rose and Switch.

chain, which actuates a ratchet device; the switch contacts are of silver, and the insulation is heavily glazed marmorite. The terminals are of the large loop-in type, and are separated by a bridge with holes for the flexible cord. Obviously the lamp and flexible need not be disturbed in the action of switching, thus avoiding injury to both.

The "Fyro" Fire Extinguisher.

A fire extinguisher, to be reliable and always ready for instant use in case of emergency, must be simple in construction, have as few working parts as possible, and be capable of being instantly removed from its fastenings and used by those least experienced.

It is claimed that the "Fyro" fire extinguisher fulfills these conditions. It is simple in construction, is light, and can be worked with one hand, if necessary, no mechanical force being required to operate it. There is no waste of extinguishing fluid, as is so often the case with many extinguishers, where the stream has such force that it is shot through the flames. This extinguisher will throw a spray a distance of 10 ft., or by opening the valve an extra half-turn, it will throw a stream 25 ft. The spray is most effective on small fires scattered over a comparatively large area; the stream is usually best for fires concentrated in one spot.

The extinguisher is cylindrical in form, 3 in. in diameter and 14 in. long, and weighs when charged 5¼ lb. At the top is the needle valve through which the fire-killing fluid is discharged, and running through the centre from the needle valve almost to the bottom is a siphon tube. The air pressure in the cylinder forces the "Fyro" fluid up this tube, holding it permanently against the valve, thus forming a "liquid seal," which makes impossible any leakage of air pressure and prevents deterioration or loss of strength with age. In the event of the contents

being partly used, the extinguisher will be just as effective upon the next fire in proportion to its bulk as it was originally.

Brackets are supplied for supporting "Fyro" fire extinguishers, which are carefully designed with a view of allowing the latter to be instantly removed. "Fyro" fluid is a combination of chemicals in liquid form; it contains neither acids, alkali nor salts; is non-poisonous, free from moisture, non-corrosive, and a positive non-conductor of electricity. When the contents of the extinguisher come in contact with the fire, the fluid volatilises, forming 4,000 cb. ft. of dense combustion arresting gas five times as heavy as air, which quickly envelopes the flames, displacing oxygen and thereby extinguishing the fire. The gas generated can be breathed by the operator without injury.

These extinguishers are easily recharged, the only additional apparatus necessary being a tire inflating pump and gauge. It is claimed that they have successfully extinguished electrical fires

Fig. 3.—"Fyro" Fire Extinguisher.

caused by short circuits, and owing to the fluid being a non-conductor of electricity, there is no danger to the operator, or harmful results to the plant. The "Fyro" extinguisher is supplied by Messrs. Turners & Manville, Ltd., of 5, Lloyd's Avenue, E.C.

Witton-Kramer Electric Drills.

In the "1914 Runthru No. 5" drill, constructed by the Witton-Kramer Electric Tool and Hoist Co. (for whom the General Electric Co., Ltd., 67, Queen Victoria Street, E.C., are the sole selling agents), a considerably more powerful tool has been produced without any increase in the weight, which stands at 57 lb. These improvements have been effected by reducing the waste space in the top cover and gear box, and have not involved a reduction in the strength or efficiency of the mechanical or electrical working parts. This tool will drill a 1¼-in. hole in cast-iron at the rate of 1 in. a minute. As will be seen from the accompanying illustration, the drill is of rugged design, the solidity of the working parts being the outstanding feature of its construction.

Viaco Insulators.

The Electrical Engineering and Equipment Co., Ltd., of 109, New Oxford Street, W.C., send us particulars of their Viaco insulators, which are moulded from a special material, which has been produced with a view to overcoming the disadvantages of porcelain. In particular, these insulators are said to be almost unbreakable, and absolutely weatherproof.

The mechanical work required to break a Viaco double-petticoat insulator, as found by a German testing institution, amounted to 1·51 ft.-lb., while ·67 ft.-lb. was sufficient to break a porcelain insulator of equal diameter and equal thickness of petticoat.

Other tests show that Viaco insulators of the smallest type have

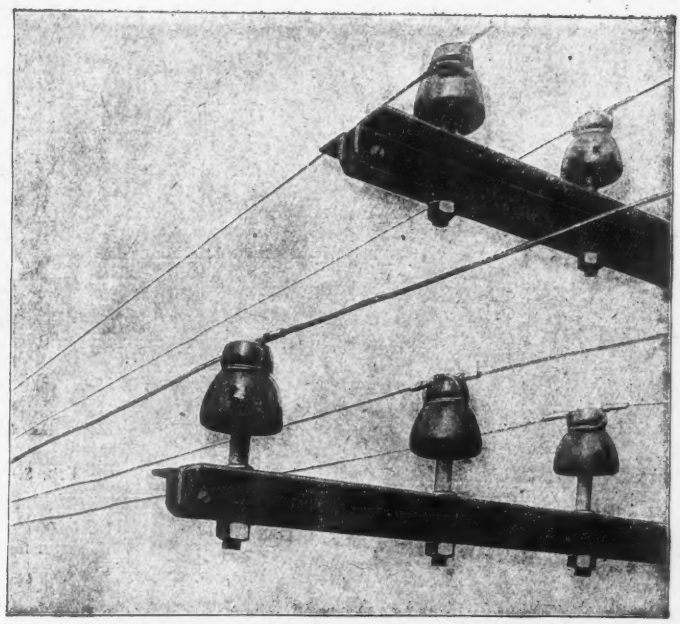


Fig. 5.—Viaco Insulators, showing Effect of Shots.

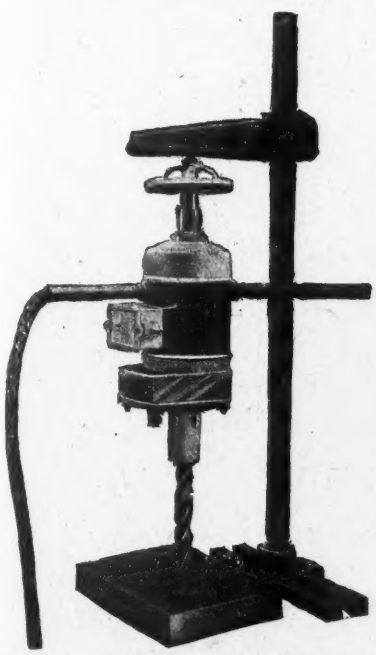


Fig. 4.—Witton-Kramer 1914 "Runthru No. 5" Drill.

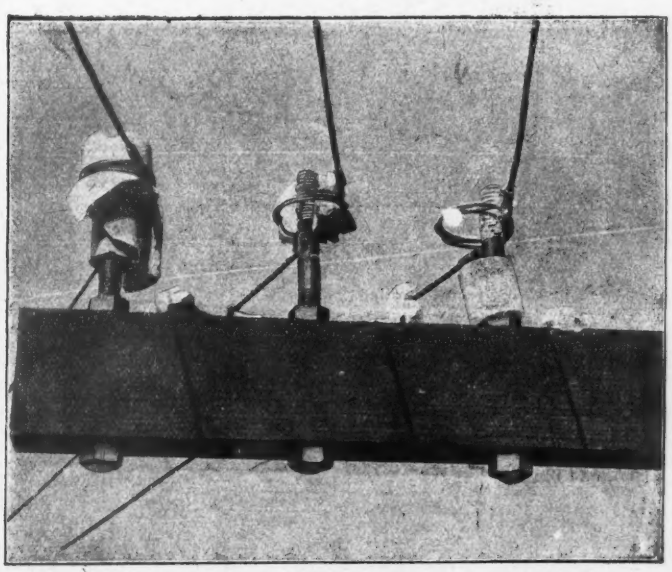


Fig. 6.—Ordinary Porcelain Insulators Shot Away.

an insulation resistance of 29,000 megohms on the average, while for double-petticoated insulators the figure given is 60,000 megohms; under equal conditions, porcelain insulators show an insulation resistance of only 1,000 megohms on the average.

These insulators are made normally with $\frac{5}{8}$-in. Whitworth or G.P.O. special threads; their mechanical strength is shown by the comparison between our two views of the results of similar treatment meted out to both porcelain and Viaco insulators, and is an obvious advantage for transport purposes.

A Carron Cooker.

The accompanying view (fig. 7) illustrates one of the Carron Co.'s latest pattern cookers, which they make in four sizes, 13 in., 15½ in., 17 in., and 21 in. wide inside the oven.

Every part of the cookers is standardised, and they are arranged for switchboards with one pilot lamp and main switch, or pilot lamp to each element.

The ovens are double-cased and packed, and have porcelain enamelled inner and outer casings of sheet-steel; the heating elements are fixed at the top and bottom, and three-heat regulation is provided.

Fig. 7.—Carron Cooker with Switchboard.

The cooker is fitted with a polished hob, grill and boiling plates, which latter vary in size and number according to the size of cooker; a porcelain enamelled crown plate is supplied, which is removable for cleaning.

The 6-in. boiling plates are loaded for 600 watts, and the 8 in. for 1,100 watts—three-heat regulation in each case. The grill, 10 in. wide × 9 in. deep, is loaded for 1,250 watts. These cookers are recommended for hiring out.

Dry Air Filter.

We have received from Messrs. Dryers, Ltd., of 71, Queen Street, E.C., particulars of their dry air filters on the "Bollinger" patent system, for turbo-generators.

Fig. 8 shows two complete filter chambers with intake pipes suitable for small generators or air compressors. For large installations a group of filter screens is employed, the screens usually measuring about 40-in. wide, 50-80 in. high, and 12 in. thick. The chambers are of sheet steel.

The screens consist of pure wool strings stretched in metal frames, arranged so that the strings of one layer cover the spaces of the adjoining ones. The strings are so close that the fibres intermingle forming a loose but efficient filter mesh for dust, offering little resistance to a current of air at moderate speed. Wire screens are also provided on each side of the chamber to prevent anything other than dust passing to the filter. Only one set of spare screens is needed to replace dirty screens, which can be done while the plant is in use.

The "Bollinger" system is claimed to cost no more, and frequently less, than other systems. A special feature is the low resistance to the air and small power requirements. Further figures are given to show that an ordinary cloth filter to deal with

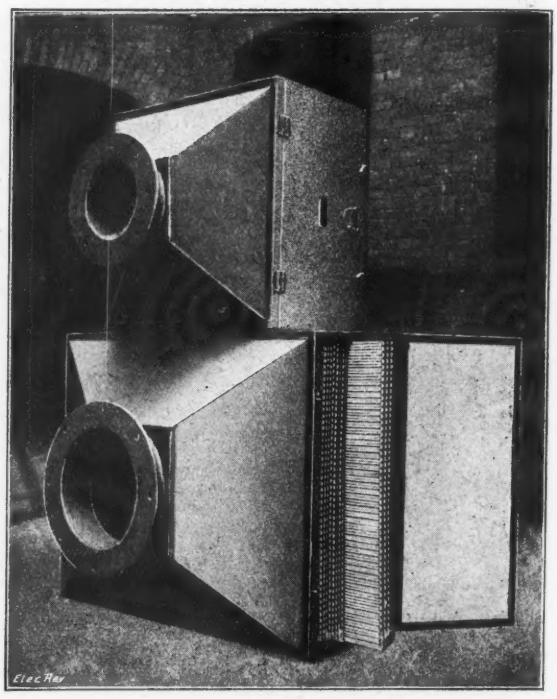


Fig. 8.—Dry-Air Filters on the Bollinger System.

1,800,000 cb. ft. per hour required 1,080 cb. ft. of space, while the Bollinger filter for this duty required only 167 cb. ft.

Brooke Semi-Diesel Engine.

Our illustration, fig. 9, shows a 15-H.P. hot-bulb two-stroke engine built for experimental purposes by Messrs. J. W. Brooke and Co., of Lowestoft, whose long experience in the construction of petrol and paraffin motors should enable them to offer a first-class engine of this type.

The design of these hot-bulb motors has now reached a point where even the details have almost become standardised, and, excepting for one or two minor improvements, Messrs. Brooke's model is an embodiment of the best features from other well-known and well-tried makes.

Extreme simplicity is the ruling feature in this type of engine when compared with ordinary oil engines fitted with valves and

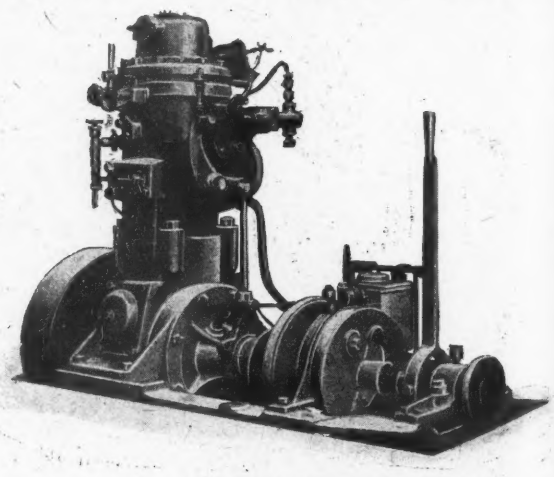


Fig. 9.—Brooke Semi-Diesel Engine.

gear, vaporisers and other complications, while its consumption of cheap, heavy oil is very little higher than in the Diesel engine itself.

Excepting for the main moving parts, essential in every engine, there is only a small plunger pump for injecting the oil into the cylinder, and this is driven by an eccentric on the crankshaft.

Messrs. Brooke intend to place a range of hot-bulb engines on the market shortly for both stationary and marine purposes.

LEGAL.

THE SHOEBURYNESS PICTURE PALACE CO., LTD., *v.* THE UNION ELECTRIC CO.

IN the Commercial Court of the King's Bench Division, on March 6th, Mr. Justice Pickford heard this action, claiming damages for the alleged failure of the defendants to deliver—under a contract with the plaintiffs— a dynamo for use at their theatre, which, it was said, the defendants knew plaintiffs required to be delivered by May 6th, 1913, in view of their proposed opening of the house on Saturday, May 10th. The defendants admitted that the dynamo was not delivered by May 6th, but they said the plaintiffs accepted their offer to lend a machine temporarily, and that the date of delivery under the original contract was extended.

Mr. Hinde appeared for the plaintiffs, and Mr. Brandon for the defendants.

MR. HINDE said that through the failure of the defendants to deliver the dynamo on May 6th, they were put to expense in buying a machine elsewhere, and suffered serious loss by not being able to open the theatre on the day arranged for. The plaintiff company was incorporated in December, 1912, to open a picture palace at Shoeburyness early in 1913. There were negotiations for the purchase of a dynamo to light the theatre, there being no local supply. Eventually the defendants, about the end of March, wrote to say they could supply a dynamo of the latest design, of good construction, and warranted to give good results, and it would be constructed to meet the requirements of the British Engineering Standards Committee, and they guaranteed it for 12 months from the date of its despatch. The price was subject to 2½ per cent. for cash within 30 days, and it was said that defendants would require for delivery three or four weeks from the receipt of order. The defendants were told that the theatre was to be opened on Saturday, May 10th, and they ordered a dynamo on the understanding that it should be delivered by May 6th. On May 5th the plaintiffs had a telegram from defendants to the effect—"Regret unavoidable delay, impossible to deliver till towards end of week." The defendants wrote to say they regretted the delay, but it was through circumstances outside of their control as there was delay in the test room, and they had had to order certain alterations. Eventually the defendants offered to loan another dynamo temporarily, and this arrived on the morning of May 9th. This dynamo would not generate electricity, and the suggestion made by the defendants (counsel understood) was that the plaintiffs tried to work it in the wrong direction. The result of it all was that the opening of the house did not come off on May 10th, and plaintiffs had to send their electrician to London to get a Crompton dynamo, and with the aid of this they opened the picture palace on the Monday. When they experimented again with the defendants' dynamo, it would not work until they substituted the Crompton resistance that plaintiffs had bought elsewhere. Eventually, counsel added, plaintiffs said they would not have the defendants' dynamo ordered under the contract, but eventually they consented to take delivery. The plaintiffs claimed damages for the expenses to which they had been put, and for loss of takings on the day that they failed to open the theatre as arranged.

MR. HOWARD HALLEY, of the plaintiff company, stated in evidence that there was no electricity available at Shoeburyness, and they had to get a dynamo for their theatre. They ordered the dynamo subject to the condition of delivery by May 6th, and by that date all the arrangements for the opening were well forward. On May 6th witness told defendants over the telephone that they must send a dynamo that was ready for work, and defendants said they would see to that, and all the plaintiffs would have to do would be to attach it to the bed, as it was all ready, and had only recently been running at another picture palace. The dynamo arrived on Friday, May 9th, and it was fixed up for running immediately, but it would not work so as to generate electricity, and the opening on May 10th did not come off, although 600 people had assembled in anticipation of the event—an event that had been widely advertised locally. They sent their engineer to London, and he bought a Crompton dynamo at Hammersmith, that arrived on the Sunday night, and they opened on the Monday. On May 25th the machine supplied by the plaintiffs was tested, and after the defendants' man had practically overhauled it, he managed to get it to excite. He, however, had to use the resistance from the Crompton machine.

MR. ARTHUR MEADOWS, of Cheapside, electrician, of 11 years' experience, said he was employed by the plaintiff company in connection with the installation of electricity at the theatre, and he was of opinion that the defendants' dynamo was not fit for the purpose supplied.

Cross-examined: He did not agree that the trouble was due to the fact that the engine was running in the opposite direction to the dynamo. The machine was "excessively hot," and too hot for proper use.

Counsel: I can tell you that before and after this machine has worked satisfactorily for other cinemas. Does not that suggest to you that you did not know how to use it?—Not a bit.

The JUDGE: What is your explanation of the fact that you and others could not work it on the 10th and their man on the 25th got it to go satisfactorily?—I should say the explanation is that it was a freak, as their man said he had known it to occur before.

Re-examined: Witness said it was impossible to use the machine before the Crompton resistance was put in.

MR. A. S. JONES, electrical engineer, spoke to being engaged by the plaintiffs to do the necessary work when the dynamo was installed at the plaintiffs' establishment. He tried every possible means of getting the dynamo to work, but without success; subsequently, he went to London and bought a dynamo for £20, and on Monday they got sufficient current to allow the theatre to be opened.

Cross-examined, Witness said that when the defendants' dynamo did work, it got hot too quickly. He was not personally interested in the plaintiff company.

MR. HAROLD SIMMONS, M.I.E.E., consulting engineer, said it was a simple thing to make cross-connections without reversing the direction of rotation of the machine. He had heard the evidence given as to what was done with the dynamo, and in his opinion it was perfectly reasonable and proper. His impression was that when the machine came the field rheostat was faulty, so that whatever they did with the dynamo in regard to direction of rotation, no result could be obtained.

On behalf of the defendants, MR. BRANDON said his case was that the dynamo was a perfectly proper one. The defendants did not undertake to fix it. That was no part of the contract, and they had the right to assume that the plaintiffs would have reasonably competent electricians to fix it for them. This dynamo had been at another cinema before, and had worked perfectly satisfactorily. The fault was entirely due to the plaintiffs. He submitted that in regard to the damages, the only damages the defendants could possibly be held responsible for was the reasonable cost of installing or removing the dynamo which was sent temporarily. Since leaving the plaintiffs' premises the dynamo had gone to another cinema, and no complaint whatever had been received in regard to it.

MR. H. E. MOUL, technical adviser to the defendant company, said he had no plans to show which way the dynamo was to run. When it was found that the machine would not generate it was quite easy to reverse the shunt connections and make it generate in about 10 minutes.

MR. J. POMFREY, another expert, expressed the view that it would have been an easy matter to have made the dynamo work in the first instance.

MR. W. RANDALL, electrical engineer, said that he went down to Shoeburyness and made the dynamo run satisfactorily for two and a-half hours, and it was then giving sufficient power to run both the cinema and the electric lighting. He was satisfied then that the machine would have run right on for a week. There was only a normal amount of heat generated.

MR. A. H. DYKES, M.I.E.E., said he had heard the evidence given, and he was of opinion that if a dynamo failed to excite, the thing to do was to reverse the shunt connections.

If the resistance was too high, was that a difficulty simple to remedy when you only want the machine for a day or two?—A very simple matter; just alter the connections.

MR. JUSTICE PICKFORD, delivering judgment, said that the defendants said that as they were not under contract to fix the dynamo, they thought that the plaintiffs would have obtained the aid of competent people. The temporary dynamo had an imperfect regulator or resistance, and they could not get the machine to excite, although a Mr. Jones, a Mr. Meadows, and a Mr. Holroyd, in the employ of the Government at the local barracks, did all they could. A simple explanation was suggested at first, that they should have changed or reversed the electrical action of the machine as it was running the wrong way, but the plaintiffs' men denied that they neglected any such elementary precaution. A test was held eventually, a man came down, and soon the machine worked better. If the defendants had sent the machine by the quickest possible means and not driven it to the last moment there would have been time for the plaintiffs to have communicated with the defendants and got them to send somebody down. He (the Judge) could not explain why the plaintiffs' men could not get the dynamo to work, but he could not say that it was entirely the fault of the plaintiffs, as if the defendants had taken proper steps they would have got it to work at the required time. He thought, however, it was unreasonable for the plaintiffs to send to London and buy a new one, and he could make no allowance in regard to that. The question only remained what damages should be awarded to the plaintiffs for the failure to open on May 10th as arranged, and he had come to the conclusion that he would award the plaintiffs £20 altogether, and there would be judgment for the plaintiffs for £20 and County Court costs. He was of opinion that the plaintiffs' claim was exorbitant, especially the item of £100 alleged to have been lost by the failure to open on the Saturday.

Judgment accordingly for the plaintiffs for £20 and County Court costs.

MARX *v.* ELECTRIC UTILITY CO., LTD.

AN application was made to Mr. Justice Pickford in the King's Bench Division that this case, at present in the warned list of non-jury actions, should be fixed for hearing on March 30th next.

MR. BERESFORD, on behalf of the plaintiff, made the application, and said that it would be a great convenience to all the parties if his Lordship would assent to this course. The grounds of the application were that a necessary witness was resident in Berlin, and could not conveniently attend before that date.

MR. JUSTICE PICKFORD: Does it take 30 days to get from Berlin?

COUNSEL: No, but at present we are unable to get at him.

MR. JUSTICE PICKFORD said that he could not fix the case for the day mentioned, but he would say that it should not be taken before March 30th, and the parties would have to be subject to the "warned list."

Garrett *v.* Toseland.

At the Northampton County Court, recently, Messrs. F. T. & A. Garrett and Co., electrical engineers, Northampton, claimed from William Toseland, innkeeper, the Royal Standard Inn, Luton, £11 11s., balance of amount due for work done. The evidence was to the effect that plaintiffs were engaged by defendant to install electric lighting in the public part of the house. While the work was in progress it was suggested the whole of the house should be lighted, it being stated that the brewers would pay part of the cost. The defendant denied liability for this portion of the work, though it was admitted it was satisfactory. The brewers had not paid. The *Northampton Herald* states that judgment was given for plaintiff.

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

4,583. "Metallic conduits for electric conductors." C. F. Burton, Senr., H. Burton and C. F. Burton. February 23rd. (Complete).

4,590. "Electric-light bulb." W. C. M. Pettingill. February 23rd.

4,592. "Means whereby the position of a sunken vessel may be located and telephone connection established." A. Butler. February 23rd.

4,616. "Globes and shades for electric, gas, and oil lights and means for ruary 23rd.

4,615. "Globes and shades for electric, gas, and oil lights and means for mounting same." C. E. Storrar, J. H. Storrar and R. A. Storrar. February 23rd.

4,619. "Telephone system." P. Lavery and W. E. Bandlow. February 23rd. (Convention date, February 24th, 1913, United States). (Complete).

4,627. "Reflector-arm for electric lamps." M. Chalier. (Convention date, March 22nd, 1913, France). (Complete). February 23rd.

4,632. "Automatic switch more especially intended for use in connection with flash-light signs illuminated by electricity or gas." F. Jahn and R. P. Myers. February 23rd.

4,655. "Electric light lamps for motor-driven power and motor vehicles." A. Christmas. February 23rd.

4,663. "Circuit interrupters." British Westinghouse Electric and Manufacturing Co., Ltd. February 23rd. (Westinghouse Electric and Manufacturing Co., United States). (Complete).

4,664. "Production of electric waves for wireless telegraphy, telephony and the like." Polyphos Elektrizitats, Ges.m.b.H. February 23rd. (Convention date, February 26th, 1913, Germany). (Complete).

4,666. "System of wireless telegraphy." H. Wade. February 23rd. (Harold Steele Mackaye, United States).

4,681. "Train lighting and similar systems." Vickers, Ltd. February 23rd. (Franz Krizik, Austria). (Complete).

4,716. "Telephone receivers." R. Woodland. February 24th.

4,735. "Electrically-operated and other presses." A. H. Railing, A. Peacock and T. H. Hutchinson. February 24th.

4,742. "Electric furnaces." J. L. Dixon. February 24th.

4,751. "Dynamo electrical machines." Hon. Sir Charles Algernon Parsons and A. H. Law. February 24th.

4,758. "Electric-lamp stand." F. W. Golby. February 24th. (Wizard Electric Lamp Co., United States).

4,762. "Electric machines." C. F. Kettering and W. A. Chryst. February 24th. (Convention date, March 7th, 1913, United States). (Complete).

4,766. "Automatic door switch." H. Westcott. February 24th.

4,783. "Electric incandescent lamps." F. Loewenstein. February 24th. (Complete).

4,784. "Process for coating metallic surfaces with brass." S. O. Cowper-Coles. February 24th.

4,785. "Process for coating metallic articles with lead." S. O. Cowper-Coles. February 24th.

4,786. "Electrolytes for the electro-deposition of zinc." S. O. Cowper-Coles. February 24th.

4,787. "Electrolytic process for the production of rustless iron." S. O. Cowper-Coles. February 24th.

4,788. "Electrolytic process for the production of rustless iron alloys." S. O. Cowper-Coles. February 24th.

4,793. "Electricity meters." Electrical Apparatus Co., Ltd., and H. C. Turner. February 24th.

4,803. "Electric motors." Phœnix Dynamo Manufacturing Co., Ltd., and R. Pohl. February 24th.

4,813. "Electric lighting systems." British Thomson-Houston Co., Ltd. February 24th. (General Electric Co., United States).

4,815. "Long-stroke electro-magnets and reciprocating electro-magnetic mechanisms and the like." Fitzroy T. Chapman. February 24th.

4,819. "Selectors especially suitable for use with automatic or semi-automatic telephone systems." G. A. Betulander. February 24th. (Convention date, March 1st, 1913, Sweden). (Complete).

4,829. "Method of fixing and preserving metal fence posts, telegraph posts, and the like driven into the ground, and devices therefor." C. A. Denis. February 24th. (Complete).

4,894. "Electric lamp for the forehead, more particularly for use in surgical operations." E. Jungermann. February 25th. (Complete).

4,908. "Electrical hair brushes, massage brushes, and the like." Tokalon, Ltd., and M. F. Pratt. February 25th. (Complete).

4,917. "Electro-magnetic safety and smooth running system to be used on railways, tramways, and the like." T. A. J. Pile. February 25th.

4,929. "Electric battery lamps." S. H. G. Stuart. February 25th.

4,931. "Protective devices for electric distribution systems." British Thomson-Houston Co., Ltd. February 25th. (General Electric Co., United States).

4,934. "Incandescent electric lamps and contacts therefor." C. C. Regnart. February 25th.

4,940. "Dynamos." H. Leitner. February 25th.

4,941. "Electric heaters or resistance elements therefor." J. R. Quain. February 25th.

4,943. "Electrical heating apparatus." M. A. V. London. February 25th.

4,944. "Plating metals." W. E. Watkins. February 25th. (Convention date, August 21st, 1913, United States). (Complete).

4,957. "Electric heating apparatus." C. R. Belling. February 26th.

4,964. "Locking-devices for the bulbs of incandescent electric lamps." J. A. Vice. February 26th.

4,979. "Electrical machines." F. Ljungstrom. February 26th. (Convention date, April 8th, 1913, Germany). (Complete).

4,988. "Telephone receiver brackets." McIon J. D. Carter. February 26th.

5,012. "Method of enhancing the permeability of magnetic material." E. Wilson. February 26th

5,014. "Electric arc lamps." F. Proctor. February 26th.

5,019. "Regulators for systems of electric distribution." British Thomson-Houston Co., Ltd. February 26th. (General Electrical Co., United States).

5,037. "Telegraphy." W. Judd, B. Davies and Eastern Telegraph Co., Ltd. February 26th. (Divided Application on 9,768/13, April 25th).

5,040. "Ignition apparatus." R. Varley. February 26th. (Complete).

5,047. "Electricity meters of the mercury motor type." W. Lawson. February 26th.

5,050. "Electric arc lamps." F. W. Sturgess. February 26th.

5,069. "Electric switches." St. Helens Cable and Rubber Co., Ltd., and J. C. White. February 27th.

5,070. "Interrupters for electric circuits." A. Pollak. February 27th. (Convention date, February 27th, 1913, Austria). (Complete).

5,093. "Construction of dynamo-electric generators of the acyclic type." J. Sinclair. February 27th. (Complete).

5,115. "Metering systems for machine switching telephone exchanges." Western Electric Co., Ltd. February 27th. (Franklin Tuthill Woodward, Belgium). (Complete).

5,131. "Appliance for preventing unintentional interruptions on the telephone." R. S. O. Dudfield. February 27th.

5,132. "Automatic safety device (apparatus) preventing fire or explosion from burning gas lamps or escaping gas otherwise ignited from stove fires or short circuit, applicable to all sorts of vehicles." E. Schwyzer. February 27th. (Complete).

5,162. "Application of permanent magnetism to motor power." A. L. S. O'Fflahertie. February 28th.

5,196. "Methods and apparatus for shaping filaments for electric incandescent lamps." J. Findlay. February 28th.

5,225. "Process for the concentration of ores." S. O. Cowper-Coles. February 28th.

5,226. "Anode supports for use in the electro-deposition of metals." S. O. Cowper-Coles. February 28th.

5,227. "Flux for soldering zinc surfaces." S. O. Cowper-Coles. February 28th.

5,228. "Process for obtaining adhesive deposits of lead upon iron and steel surfaces." S. O. Cowper-Coles. February 28th.

5,234. "Dynamo-electric machines." British Thomson-Houston Co., Ltd., and J. Hutt. February 28th.

5,236. "Cells of electric batteries." M. E. Feilmann, C. R. Noble and A. E. Turnham. February 28th.

5,240. "Means for attaching insulators for electric wires and the like." T. Wittrin. February 28th. (Convention date, March 1st, 1913, Germany). (Complete).

5,246. "Telephone systems." T. Shaw. February 28th. (Convention date, February 28th, 1913, United States). (Complete).

5,247. "Systems for the transmission of electrical energy." T. Shaw. February 28th. (Convention date, February 28th, 1913, United States). (Complete).

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

28,513. Electrical Ignition. F. G. L. Biddlecombe and G. Thomas. December 10th.

1913.

788. Method of and Means for Effecting the Efficient Transmission of Electric Signalling Impulses Through Cables. A. Williams. January 10th.

802. Means for Generating Alternating Electric Currents. G. Marconi. January 10th.

3,249. Electric Control of Alternating Current Motors. Otis Elevator Co. (Otis Elevator Co.). February 7th.

3,271. Manufacture of a Material Suitable for Electrical Insulation and other purposes. British Thomson-Houston Co. (General Electric Co.). February 7th. (Cognate Application, 22,358/13).

3,339. Telephone Systems. Automatic Telephone Manufacturing Co. (Automatic Electric Co.). February 8th.

3,565. Electric Motor Control Systems. British Thomson-Houston Co. (General Electric Co.). February 11th.

3,566. Manufacture of a Material Suitable for Electric Insulation and other purposes. British Thomson-Houston Co. (General Electric Co.). February 11th.

3,596. Advertising and like Device. W. Balmford and J. McCurrison. February 12th.

3,882. Method and Apparatus for Suppressing the Interruption Arc on Electric Switches. W. Burstyn. February 14th.

4,396. Inter-communication Telephone Systems. Sterling Telephone and Electric Co. and F. G. Bell. February 20th.

4,773. Electric Machines Having Commutators. B. Ljungström and A. D. Widström. February 25th. (February 26th, 1912).

4,869. Controller for Electric Lifts and Hoists. W. J. F. Cooper and F. Barlow. February 26th.

4,927. Electrical Contact Devices Particularly Applicable to Arc Lamps. J. Brockie, and Johnson & Phillips, Ltd. February 26th.

6,861. Magazine Electric Fuse Box. R. Groves. March 20th.

7,286. Electric Lighting of Vehicles. W. G. Lee and P. J. Oldfield. March 27th.

7,853. Prepayment Apparatus for the Supply of Electricity. E. Garside. April 3rd. (Addition to 22,325/12).

8,245. Apparatus for Governing the Speed of Railway-cars or Trains. A. E. Alexander (Union Switch & Signal Co.). April 8th.

14,407. Automatic Telegraphic Apparatus. J. Gell. June 21st.

15,179. Telephone Relays. J. Schiessler. July 1st. (July 15th, 1912).

15,579. Automatic Telephone Exchanges. F. N. Reeves & A. E. Lundell. July 5th. (July 5th, 1912).

15,697. Dynamo-electric Machines. B. Brooks & W. Holt. July 8th.

19,668. Rectifiers for Alternating Electric Currents. O. W. Richardson. August 30th.

21,115. Submarine Electric Lamps. R. H. Davies. September 18th.

27,348. Means for Use in Concurrently Producing upon the same Strip or Chart Records or Diagrams Relating to Several Electric Currents. Hartmann & Braun Akt. Ges. November 27th. (January 17th, 1913).

29,240. Method of and Means for Effecting a Diplex Action in Actuating Electric Apparatus at a Distance by Means of Pulsating Electric Currents Obtained from a Source of Continuous Electric Current. E. H. Widegren and K. A. Widegren. December 18th. (December 30th, 1912).